Rivers Database Version 3

A User Manual

2007

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The Freshwater Consulting Group in association with Soft Craft Systems

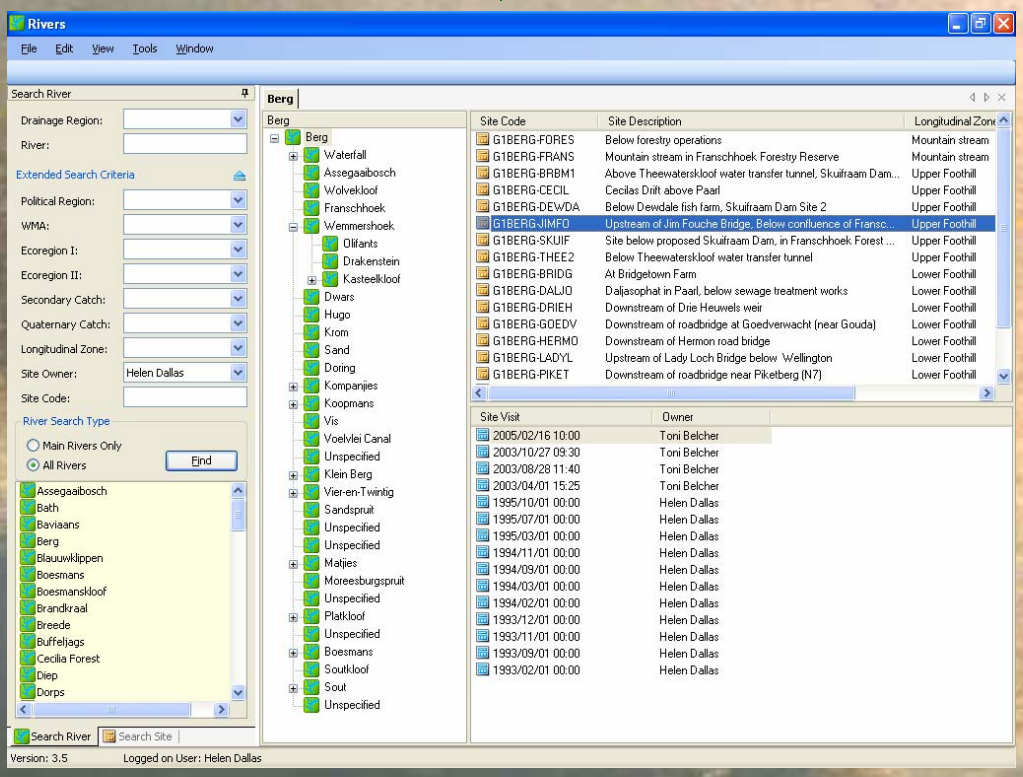
For

THE RIVER HEALTH PROGRAMME

DEPT. OF WATER AFFAIRS & FORESTRY

WATER RESEARCH COMMISSION

DEPT. OF ENVIRONMENTAL AFFAIRS & TOURISM



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To cite data in the Rivers Database:

Reference the data by listing the owners of the data (Site or Site Visit data) in the following manner.

DWAF (2007) Rivers Database: Data Owners: List data owners

TABLE OF CONTENTS

1. INTRODUCTION 1

2. RIVERS DATABASE 2007 1

2.1. Rivers Server 1

2.2. Rivers Client 2

2.3. Query Master (Server and Client) 2

2.4. System access 3

To Login to the Rivers Server (Internet connection required) 3

To Login to the Rivers Client (Internet connection NOT required) 3

To register as a new user (Internet connection required, Screens 2.1 to 2.4) 3

To change your password (Internet connection required) 3

2.5. Data ownership 5

3. RIVERS SERVER 6

3.1. River management 6

Check for existing rivers or creating a new river (Screen 3.1 and 3.2) 6

Viewing existing rivers, tributaries and associated sites (Screens 3.3 to 3.6) 7

3.2. Site photographs (Screen 3.7) 7

To upload site photographs 8

3.3. Administration - User Registration 8

3.4. Documentation 8

3.5. Query Master (Server version) 8

3.6. Rivers Administrative functions 8

4. RIVERS CLIENT 12

4.1. Using the River Tree View to navigate to Sites and Site Visits 12

Step 1: Searching by River or Site (Screen 4.1) 13

Step 2: Navigating the River Tree View (Screen 4.2) 14

Step 3: Add, edit or delete a Site (Screen 4.3) 14

Step 4: Add, edit or delete a Site Visit (Screen 4.4) 14

4.2. Viewing and adding Site Visit data: Section A 17

(a) General Site information (Screen 4.5) 17
(b) Spatial Information (Screen 4.6) 18
(c) Location Details (Screen 4.7) 18
(d) Site Transaction (read-only) (Screen 4.8) 19

4.3. Viewing and adding Site Visit data: Sections B and C 21

Viewing and adding Site Visit data: Section B – General 22

(a) Condition of Catchment (Screen 4.10) 22
(b) Channel Condition (Screen 4.11) 22
(c) Channel Morphology (Screen 4.12) 22

Viewing and adding Site Visit data: Section B – Index of Habitat Integrity 25

Viewing and adding Site Visit data: Section C 28

(a) General Site Visit Information (Screen 4.18) 28
(b) Water Chemistry (Screen 4.19) 28
(c) Stream Dimensions (Screen 4.20) 29
(d) Substratum Composition (Screen 4.21) 29
(e) Invertebrate Biotopes (Screen 4.22) 29
(f) Invertebrates (Screen 4.23) 29
(g) Biotopes Sampled (IHAS) (Screen 4.24) 30
(h) Fish (Screen 4.25) 30

5. DATA TRANSFER BETWEEN RIVERS CLIENT AND RIVERS SERVER 35

5.1. Uploading data (Screen 5.1) 35

5.2. Downloading data (Screen 5.2) 36

5.3. Assessor maintenance - adding Assessors via Rivers Client (Screen 5.3) 36

5.4. SASS proficiency status (Screen 5.3) 36

5.5. SASS data import (Screen 5.4) 36

5.6. Updates (Service Packs) 40

6. QUERYING THE DATABASE (QUERY MASTER) 40

6.1. Basic structure of the Query Master 40

Primary Data Component Selection (Screen 6.1) 40

Secondary Data Component (Combine Components) (Screen 6.2) 40

Field Selection (Screen 6.3) 40

Define Filter Criteria (Screen 6.4 and 6.5) 40

Display report (Screen 6.6) 41

6.2. Step-by-step instructions on using the Query Master 41

Creating a new query: 41

6.3. Setting criteria 46

6.4. Frequently asked questions – Query Master 47

7. TECHNICAL INFORMATION 49

7.1. Software and Hardware Requirements 49

7.2. Installing the Rivers application 49

7.3. Uninstalling the Rivers application 49

7.4. User Support for the Rivers Database 50

Reporting bugs or error messages 50

8. DOCUMENTATION 50

9. REFERENCES 50

LIST OF FIGURES

Figure 2.1 Schematic representation of the Rivers Database Version 3 (2007) architecture and data flow....2
Figure 4.1 Schematic representation of the various components included in the Rivers Database 2007 13

LIST OF DATA VIEWING AND CAPTURE SCREENS

Screen 2.1 The Rivers Database Login Screen 4
Screen 2.2 New Users Registration form – User detail....4
Screen 2.3 New Users Registration form – Experience component....5
Screen 2.4 Registration successful – Users request system access 5
Screen 3.1 Checking for existing rivers on the Rivers Server....9
Screen 3.2 Creating a new river and notifying the Rivers Administrator to ensure river validation 9
Screen 3.3 Viewing details of a river 10
Screen 3.4 Viewing tributaries of a river....10
Screen 3.5 Viewing sites on a river – the longitudinal zone and a description are provided....11
Screen 3.6 Viewing site details 11
Screen 3.7 Uploading photographs to a site 12
Screen 4.1 Searching for a river using the extended search criteria....15
Screen 4.2 Sorting the rivers in the tree view....15
Screen 4.3 Adding a site in the Site List 16
Screen 4.4 Adding a site visit from the main menu 16
Screen 4.5 Toolbar providing access to forms in Section and General Site Information....19
Screen 4.6 Spatial Information....20
Screen 4.7 Location Detail....20
Screen 4.8 Site Transaction....21
Screen 4.9 Adding a new Site Visit....23
Screen 4.10 Condition of Catchment 23
Screen 4.11 Channel Condition....24
Screen 4.12 Channel Morphology....24
Screen 4.13 Instream, riparian zone and catchment modifications 25
Screen 4.14 River type and seasonality....26
Screen 4.15 IHI instream components 26
Screen 4.16 IHI Riparian Components....27
Screen 4.17 Results and Ownership 27
Screen 4.18 General Site Visit Information 31
Screen 4.19 Water Chemistry....31
Screen 4.20 Stream Dimensions....32
Screen 4.21 Substratum composition 32
Screen 4.22 SASS and specific biotopes....33
Screen 4.23 Invertebrate Taxa....33
Screen 4.24 Biotopes Sampled (IHAS)....34
Screen 4.25 Fish data 34
Screen 5.1 Data Uploading....38
Screen 5.2 Data Downloading....38
Screen 5.3 Assessor data and SASS Validation Status 39
Screen 5.4 SASS Data Importing....39
Screen 6.1 Primary Data Component Selection 43
Screen 6.2 Secondary Data Component (Combine Components)....43
Screen 6.4 Define filter Criteria 44
Screen 6.5 Select Field values already in the Rivers Database 45
Screen 6.6 Results of the query....45

LIST OF APPENDICES

Appendix 1 Glossary of terms used in this manual 52
Appendix 2 A step-by-step example of a query setting specific criteria. 53
Appendix 3 Geological types based on Vegter (1995) giving Lithostratigraphic Unit and Principle Rock Types 55
Appendix 4 Water Chemistry codes giving the description, units, expected minimum and maximum values 59
Appendix 5 Fish codes 61

INDEX 70

1. INTRODUCTION

The Rivers Database is the national data storage and management system developed for the River Health Programme (RHP). The RHP forms a key component of the National Aquatic Ecosystems Biomonitoring Programme (NAEBP) of the Department of Water Affairs & Forestry (DWAF). This manual accompanies Rivers Database Version 3.0, which is currently distributed on CD or internet download (broadband connection required). The Rivers Database is a combination of a web-based (Rivers Server) and desktop application (Rivers Client), which allows registered users to transfer data from one to the other via a data transfer utility. All RHP practitioners using the biomonitoring tools developed for RHP are encouraged to contribute their data to the national Rivers Database. System access is controlled via compulsory user registration and site and/or site visit ownership is based on their user name. This manual has been written as a guide to users of the Rivers Database application. It is divided into the following sections:

- **Rivers Database 2007** - General structure of the database, explaining the concepts of the Rivers Server and Rivers Client and the responsibilities of each in terms of managing rivers, sites and site visit data, and transferring data between Rivers Client and Server. System Access is described, specifically: How to register as a new user and login to the Rivers Server and Rivers Client. Data Ownership is outlined.
- **Rivers Server** - Description of the functionality in the Rivers Server and how to use it.
- **Rivers Client** - Description of the functionality in the Rivers Client and how to use it.
- **Data transfer between the Rivers Client and Rivers Server** - Description of the data transfer utility and SASS data import.
- **Querying the Database** - Description of the Query Master for filtering data and querying the database (local and server).
- **Technical Information** - Hardware and software requirements, installing the Rivers Client, troubleshooting.
- **Documentation** - Information about the relevant documents.
- **References** - relevant documents.
- **Index** - an index for locating specific tasks is provided.

2. RIVERS DATABASE 2007

The Rivers Database consists of three primary components (Figure 2.1), namely the Rivers Server (web application running on the internet), Rivers Client (windows application running on a desktop) and the Query Master application (for extracting data - a local version running on the desktop and a server version running on the internet). The three primary components can be accessed via the Start: Programs: Rivers Database, or via the appropriate shortcut installed on the desktop (i.e. Rivers Server, Rivers Client and Query Master). A Data Transfer Utility is accessible via the Rivers Client, enabling data to be transferred between the Rivers Server and Client. The Rivers Database is available on CD from the Rivers Administrator or provincial champion, or can be downloaded from the Rivers website**.** The Rivers Administrator is responsible for maintaining components of the database including validating rivers, updating pick lists, invertebrate and fish lists, and assigning rights to users. For information on installing the Rivers Client please refer to Section 7.2.

2.1. Rivers Server

The River Server's primary role is to provide a real-time, centralized repository of data at a national level.

It provides a web-based interface to manage rivers, users, invertebrate and fish lists, pick lists and site photographs (Figure 2.1). The Rivers Server is accessible either through Internet Explorer or via a window in the Rivers Client application.

2.2. Rivers Client

The Rivers Client application is the primary data entry and viewing application for Site and Site Visit related data. It provides a Data Transfer Utility that allows the Site and Site Visit data to be uploaded from your desktop/laptop (i.e. **Local database**) to the Rivers Server (i.e. **National database**) via the internet in real-time (Figure 2.1). Furthermore, data that is managed on the Rivers Server (rivers, users, invertebrate and fish lists, pick lists, etc.) and Site and Site Visit related data can be downloaded from the centralized repository on the Server. The Rivers Client also provides an automated SASS data import facility that allows invertebrate data to be imported from an excel file (via creation of a .csv file).

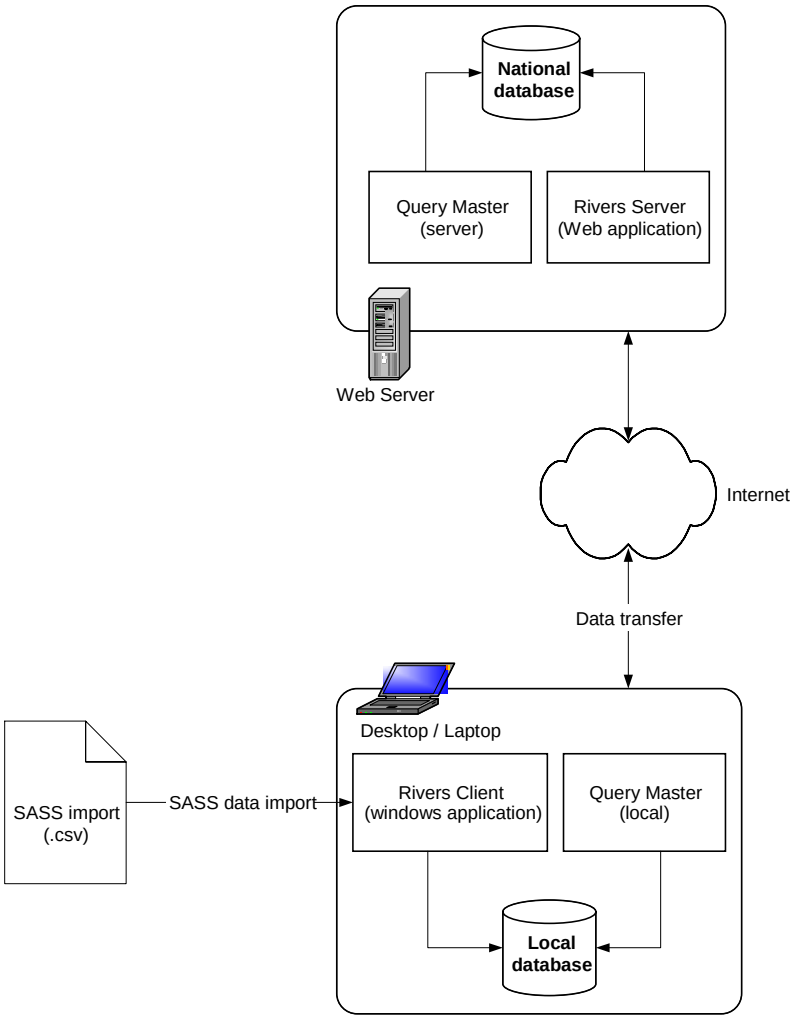


Figure 2.1 Schematic representation of the Rivers Database Version 3 (2007) architecture and data flow.

2.3. Query Master (Server and Client)

The Query Master can be used to extract data from the database. A local version of the query master runs on the desktop and a server version runs on the web server (Figure 2.1). The Query Master is accessible either through Internet Explorer or via a window in the Rivers Client application.

2.4. System access

System access is controlled via compulsory User Registration and new users need to register before being able to access the system. Once registered, the user will receive a username and password that can be used to log onto both the Rivers Server and Rivers Client. The user has the option to change the password at any time via the Rivers Client.

To Login to the Rivers Server (Internet connection required)

- Select Rivers Server (Start: Programs: Rivers Database 2007: Rivers Server or click the desktop icon). This will open Internet Explorer and display the Login page. Alternatively, access the Rivers Server via a window in the Rivers Client (Open the "Tools" menu and select "Rivers Server"). This will automatically Login to the Rivers Server.

To Login to the Rivers Client (Internet connection NOT required)

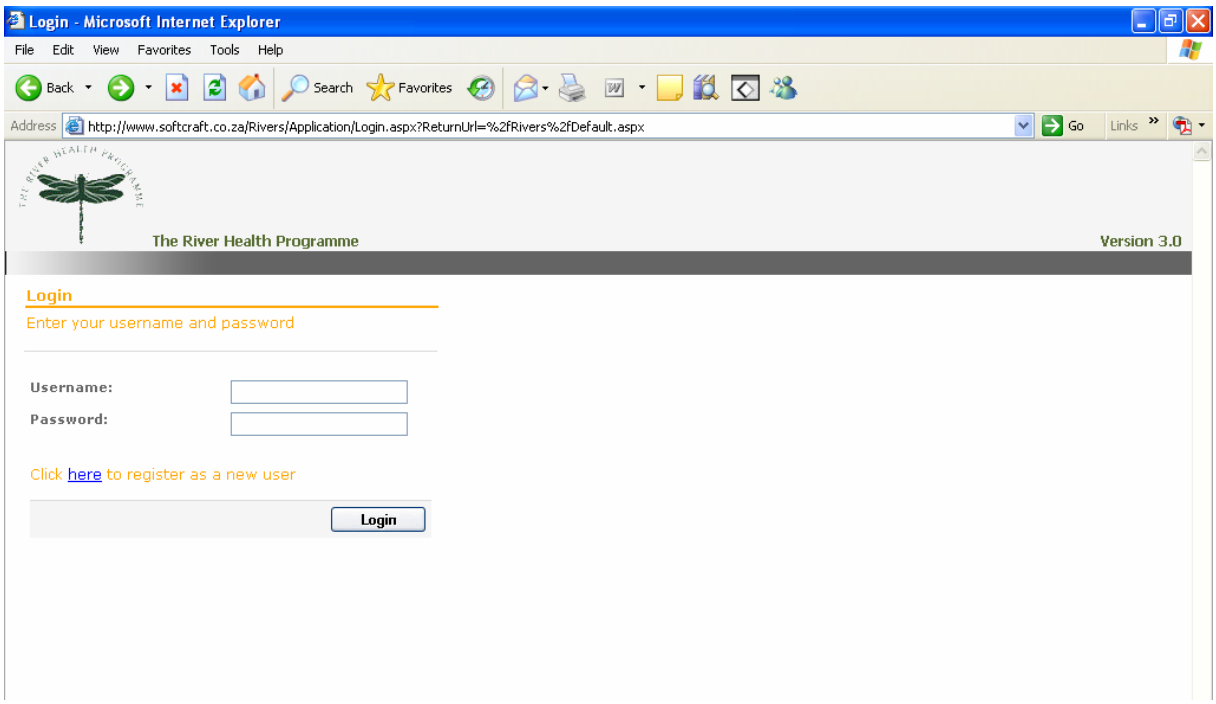
- Start the Rivers Client
- Enter the username and password and click "OK"

To register as a new user (Internet connection required, Screens 2.1 to 2.4)

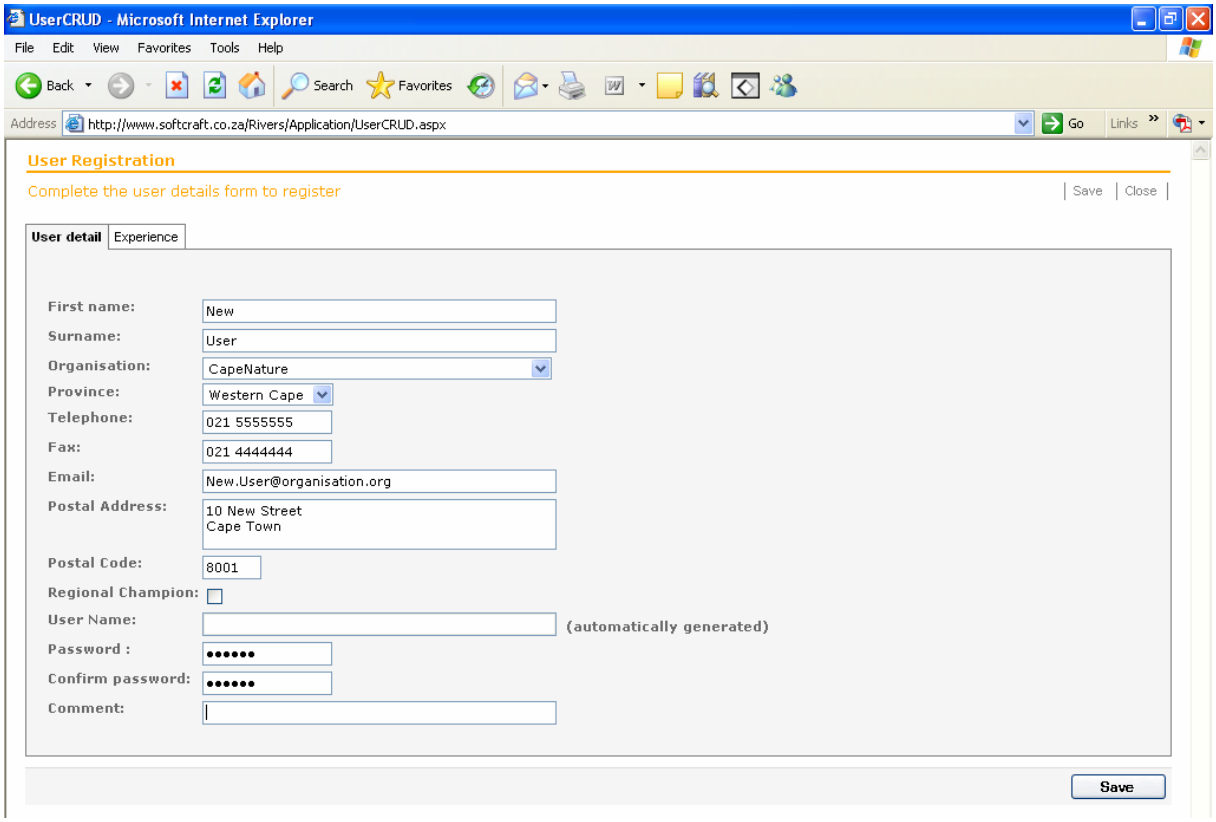
- Start Rivers Server and complete and submit (Save) the online 'User registration form'.
- Click "Request System Access" to send an email to the Rivers Administrator.
- The Rivers database administrator will verify the user details and assign appropriate access rights to the user. The administrator will confirm the username and password that can be used to access both the Rivers Server (via the internet) and the Rivers Client on the desktop, via e-mail.
- Start the Rivers Client (Start: Programs: Rivers Database 2007: Rivers Client or click the desktop icon). For information on installing the Rivers Client please refer to Section 7.2.
- Enter the username and password and click "OK".
- Follow the prompts on the screen to refresh your username and password from the Server and Login to the Rivers Client for the first time.

To change your password (Internet connection required)

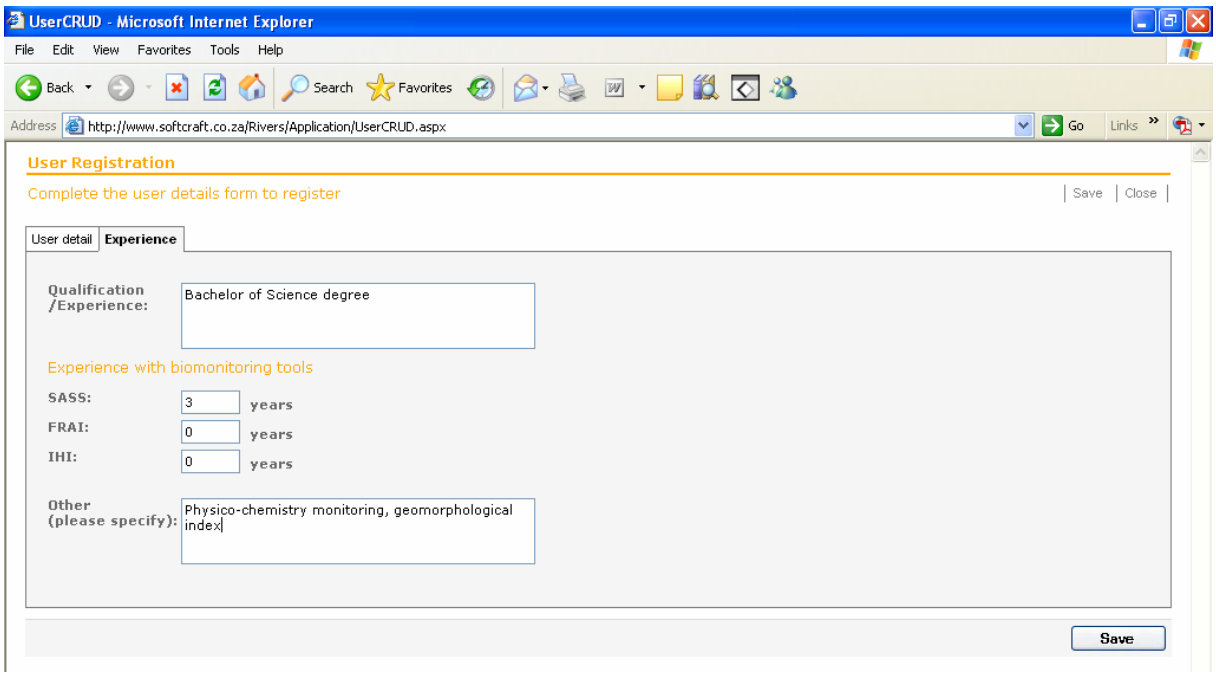
- Start the Rivers Client
- Open the "File" menu and select "Change Password"
- Enter and confirm the new password.
- Click "Submit" to update the password on both the Rivers Server and Client.



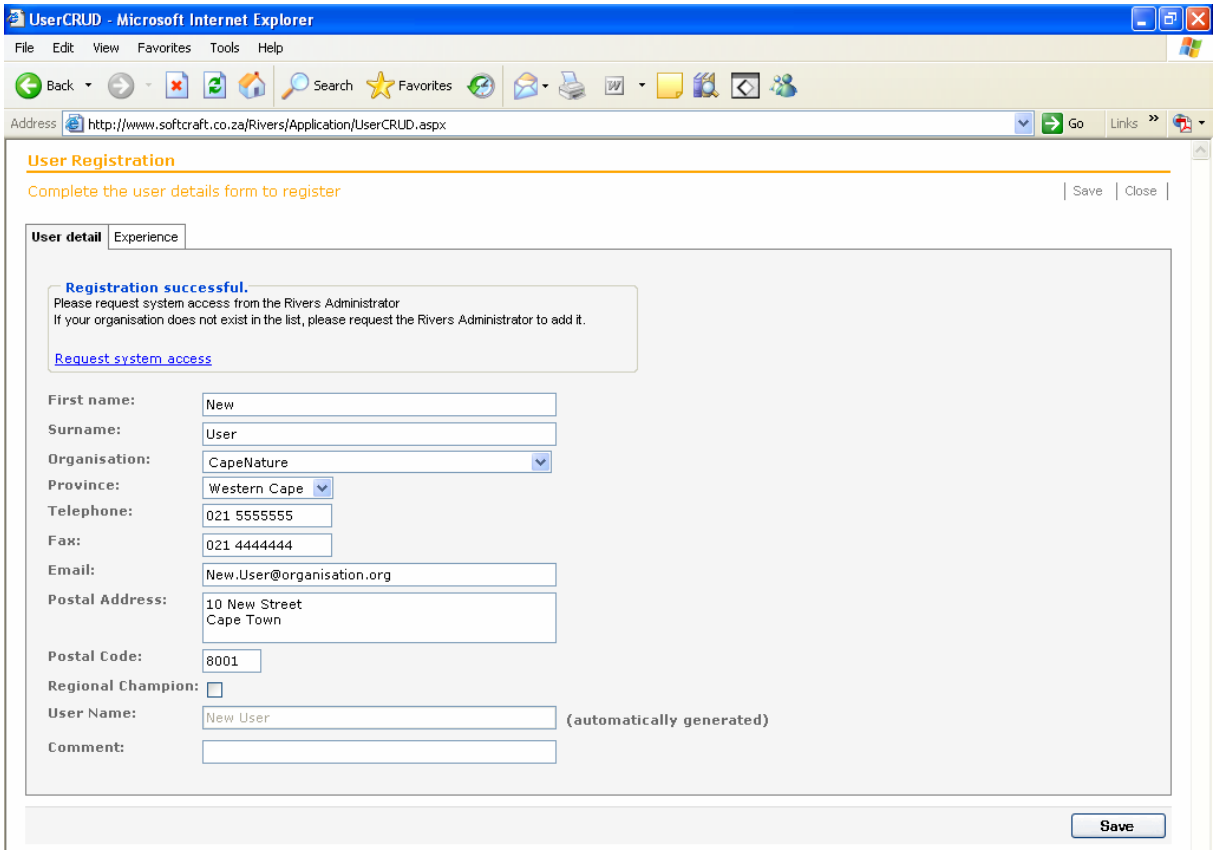
Screen 2.1 The Rivers Database Login Screen



Screen 2.2 New Users Registration form – User detail



Screen 2.3 New Users Registration form – Experience component



Screen 2.4 Registration successful – Users request system access

2.5. Data ownership

Data integrity is ensured via assigning "data ownership" to each component of the database. The Owner of the Site or Site Visit data is defaulted to the logged in user. This is often the person who located and sampled the site initially, although it is also sometimes the regional champion. The Assessor is the person who actually did the assessment (they are often the same person). When creating either a new site or site visit, the logged in user becomes the owner of the site or site visit in question. Data ownership is structured in a hierarchical manner as follows:

- **Site**: the logged in user becomes the owner of the site created. Only the Owner may edit or delete site data. Site ownership may be reassigned by selecting another user from the drop-down list in Section A. After re-assigning ownership, the original owner will no longer be able to edit or delete site data.
- **Site Visit – Section B – General**: the logged in user becomes the owner of the Site Visit created. Only the Owner may edit or delete this Site Visit data. Site Visit ownership may be reassigned via the menu Toolbar as follows: Select SiteVisit, Edit Page Header, Change Owner and/or Assessor using the drop-down lists. The general site visit ownership also includes the following components in Section C: General site visit information, stream dimensions and substratum composition.
- **Site Visit – Section B – Index of Habitat Integrity**: the logged in user becomes the owner of the Site Visit created. Only the Owner may edit or delete this Site Visit data. The Owner may reassign the Ownership and Assessor to another user/assessor via the Results and Ownership form, if appropriate. Save change of ownership using the Rivers Toolbar: SiteVisit/Save.
- **Site Visit – Section C – Water Chemistry**: the logged in user who created the Site Visit becomes the owner of the Site Visit Water Chemistry data. Only the Owner may edit or delete this data. The Site Visit Owner may reassign the Water Chemistry Ownership and Assessor to another user/assessor using the drop-down lists on the Water Chemistry form, if appropriate. Save change of ownership using the Rivers Toolbar: SiteVisit/Save.
- **Site Visit – Section C – Invertebrates** (includes Invertebrate Biotopes and Biotopes Sampled (HAS)): the logged in user who created the Site Visit becomes the owner of the Site Visit Invertebrate data. Only the Owner may edit or delete this data. The Site Visit Owner may reassign the Invertebrate Ownership and Assessor to another user/assessor using the drop-down lists on the Invertebrates form, if appropriate. Save change of ownership using the Rivers Toolbar: SiteVisit/Save.
- **Site Visit – Section C – Fish**: the logged in user who created the Site Visit becomes the owner of the Site Visit Fish data. Only the Owner may edit or delete this data. The Site Visit Owner may reassign the Fish Ownership and Assessor to another user/assessor using the drop-down lists on the Invertebrates form, if appropriate. Save change of ownership using the Rivers Toolbar: SiteVisit/Save.

3. RIVERS SERVER

3.1. River management

Rivers and their tributaries are managed centrally on the Rivers Server. Thus, if a river does not exist on the Rivers Client, it must be created on the Rivers Server and downloaded to the client. It is important to do an extensive search for the river on both the Rivers Client AND Rivers Server, before creating it, to ensure duplicate rivers are not created on the system. The Rivers Database 2007 currently contains a comprehensive network of rivers spanning all the major drainage regions at 1:500 000 resolution. This data has been imported from the DWAF trace files. Rivers created on previous versions of the Rivers Database have been consolidated into the current version. The Rivers Server is available either via Internet Explorer (Start: Programs: Rivers Database 2007: Rivers Server or click the desktop icon) or via a window in the Rivers Client (In the River Client, open the "Tools" menu and select "Rivers Server").

Check for existing rivers or creating a new river (Screen 3.1 and 3.2)

- Open the Rivers Server and Login to the Rivers Server
- Open the "River" menu and click "Rivers"

- Ensure the river does not already exist by using the "Filter" functionality to search for the river on the rivers server (i.e. type the name of the river in the River box, and click "Search"). The river, its parent and drainage region are returned.
- To view river details click on river name.
- If no matching rivers are returned, click "New".
- Enter the river details: River name – type in name.
- Assign the new river to a parent river by clicking on "Add", searching for the parent river using the filter and search functionality, and selecting the parent river).
- Assign a Political Region and Drainage Region for the new river; and click the 'Save' button. Note: the Drainage region of the new river must match the drainage region of the parent river.
- Add the Sort Order (if known) by assigning a sort number one greater than the upstream tributary, i.e. if the tributary joining the mainstem immediately upstream has a sort order of 5, assign your new tributary a sort order of 6. If the sort order is not known leave as blank.
- Notify Administrator of the creation of a new river (NB: Add the co-ordinates of a site on the new river to assist validation).
- Unvalidated rivers remain red until they have been validated by the Rivers Administrator. They can be searched for by selected "Unvalidated" in the filter box of the Rivers form.
- Once email verification is received, download the river list to make the river available on the Rivers Client (see Section 5.2: Download Data in the Rivers Client section of this document).

Hint: For users with access to Geographical Information Systems (GIS), it is useful to plot the site on the 1:500 000 rivers coverage to see where it lies in relation to existing rivers. Sometimes your river name may be different to the national name. This avoids unnecessary duplication of river names or incorrect river name allocation. **Various coverages are provided on the Rivers Database CD.**

Viewing existing rivers, tributaries and associated sites (Screens 3.3 to 3.6)

- Open the Rivers Server and Login to the Rivers Server
- Open the "River" menu and click "Rivers"
- Use the "Filter" functionality to search for the river
- Select the river by clicking on the river in the list
- Click on "Tributaries" tab to view tributaries of the selected river
- Click on "Sites" tab to view sites on the river
- To go to a specific tributary, click on the tributary name in the list. Tributaries of the selected river and sites may be viewed.
- To navigate back to the parent river, click on "Tributary of" in right hand corner of screen
- To view details of a site, click on the RHP Site Code. Details include the Site Description, Site Owner, Longitudinal Zone, GeoReference, (Lat: °; Long: °) and Location.

3.2. Site photographs (Screen 3.7)

Photographs of the upstream, downstream, bank-side views or specific features at the site can be uploaded to the Rivers Server. In addition to the photo date and an optional comment, the area or feature photographed is selected from a drop-down list to maintain a record of user-specific photographs. Users may "Add" photographic material. Only the Site Owner may delete photographs. Site photographs are not maintained on the Rivers Client but are uploaded and viewed directly on the Rivers Server (as .gif or .jpg files). This upload process is independent of the Site and Site Visit data upload process that is available on the Rivers Client. **Users need to reduce the size of their photographs before uploading (<1mb).** Extracts of 1: 50 000 topographical maps, saved as .jpg or .gif files, can also be uploaded.

To upload site photographs

- Open the Rivers Server and Login to the Rivers Server
- Open the "River" menu and click "Rivers"
- Use the "Filtering" functionality to search for the river on which the site is situated
- Select the river by clicking on the river in the list
- Click on the "Sites" tab to view a list of sites on the river
- Select the site by clicking on the RHP Site Code in the list
- Click on the "Site photo/s" tab to view a list of photos for the site
- Click "New" in the site photos tab
- Enter the site photo details and select the path of the image to be uploaded and click the "Save" button.
- To view the image, click the box and select View". The image opens in a separate window.
- The image may be "Saved:, "Printed" or "Emailed" (Right-click and select option)

3.3. Administration - User Registration

Users may update their "User detail and Experience" using the forms provided.

3.4. Documentation

Users may download the Rivers Database Version 3 (2007) user manual as a pdf file. The Site Characterisation manual (Dallas 2005) and other relevant pdf files are also provided.

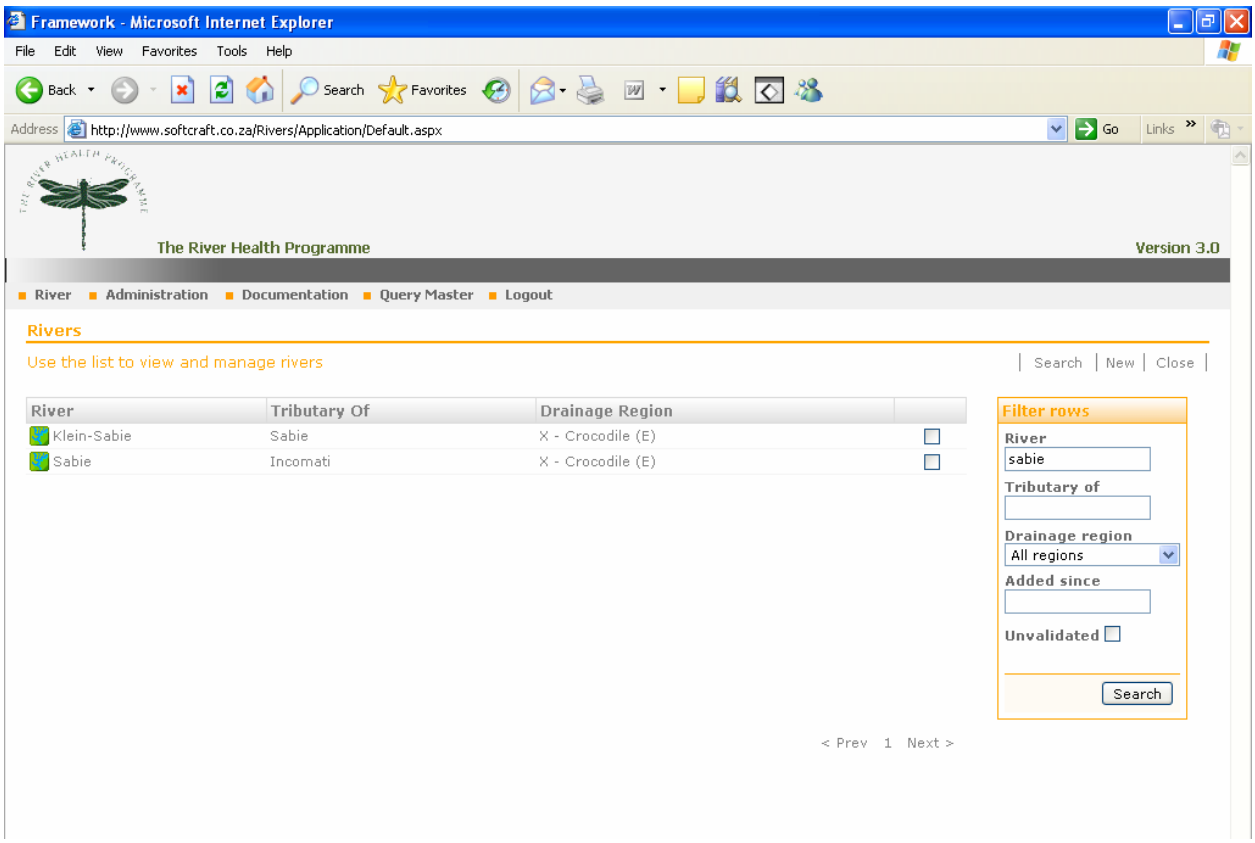
3.5. Query Master (Server version)

The Rivers Server provides access to the server version of the Query Master, providing views into the national rivers database. This is useful to extract data on the national database that the user may not have downloaded onto the desktop version (i.e. Rivers Client). Details pertaining to the functionality of the Query Master are given in Section 6 of this manual.

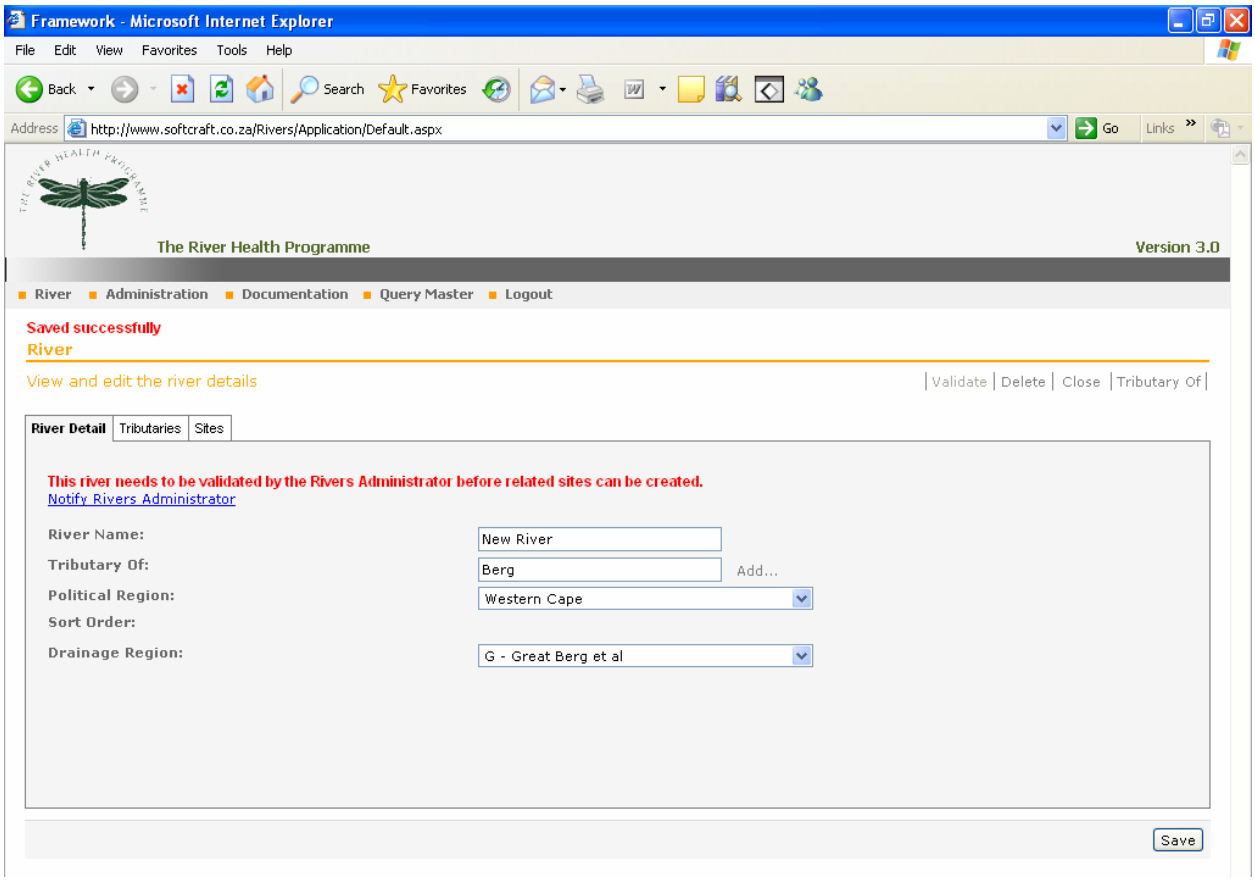
3.6. Rivers Administrative functions

Rivers Administration functions are available to specific Users.

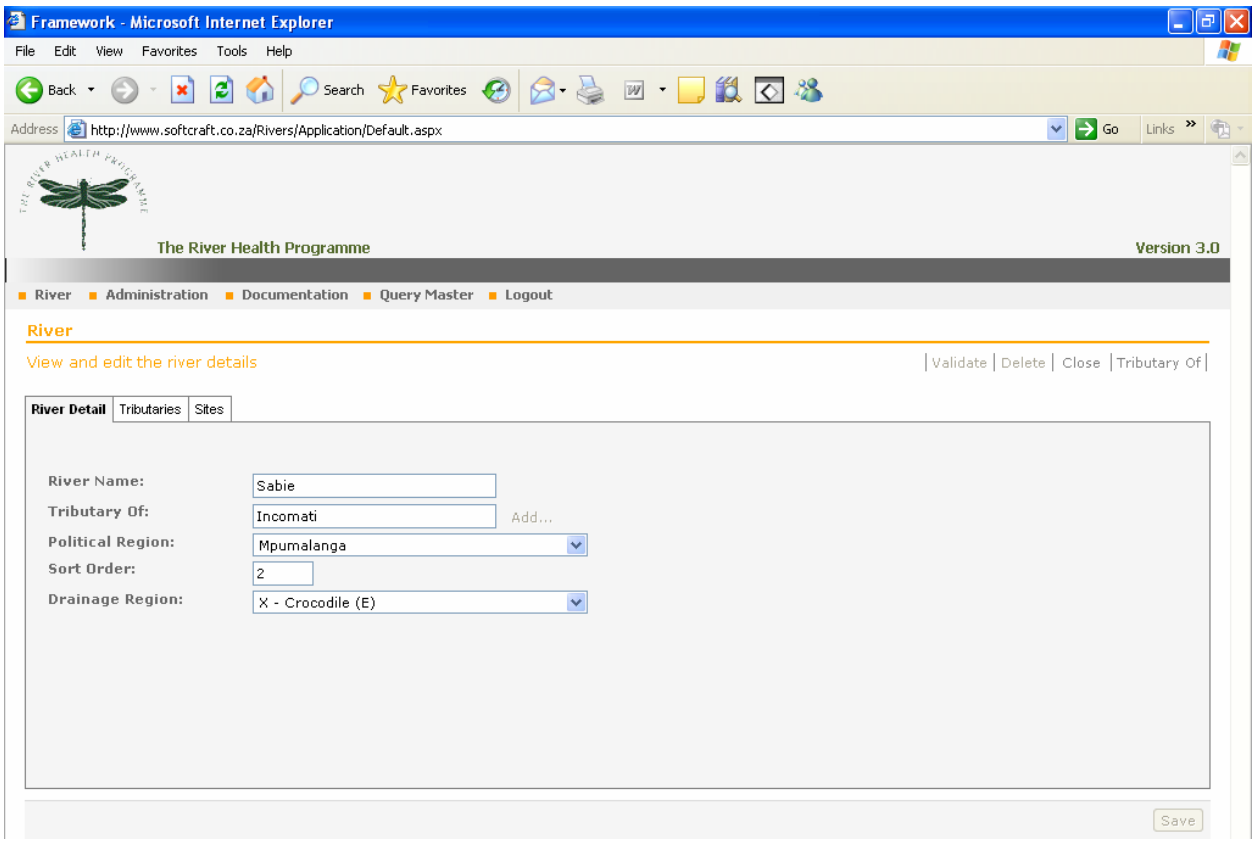
- **DWAF trace file import:** Update the river networks using trace files from DWAF
- **Pick lists:** Maintenance of the drop-down lists in the database.
- **Invertebrate taxa:** Maintenance of the list of the invertebrate taxa, their associated groups, and a record of there inclusion in SASS4 and SASS5.
- **Fish data:** Maintenance of the list of fish taxa
- **Users and organisations:** Maintenance of the list of all database users and their organisations.



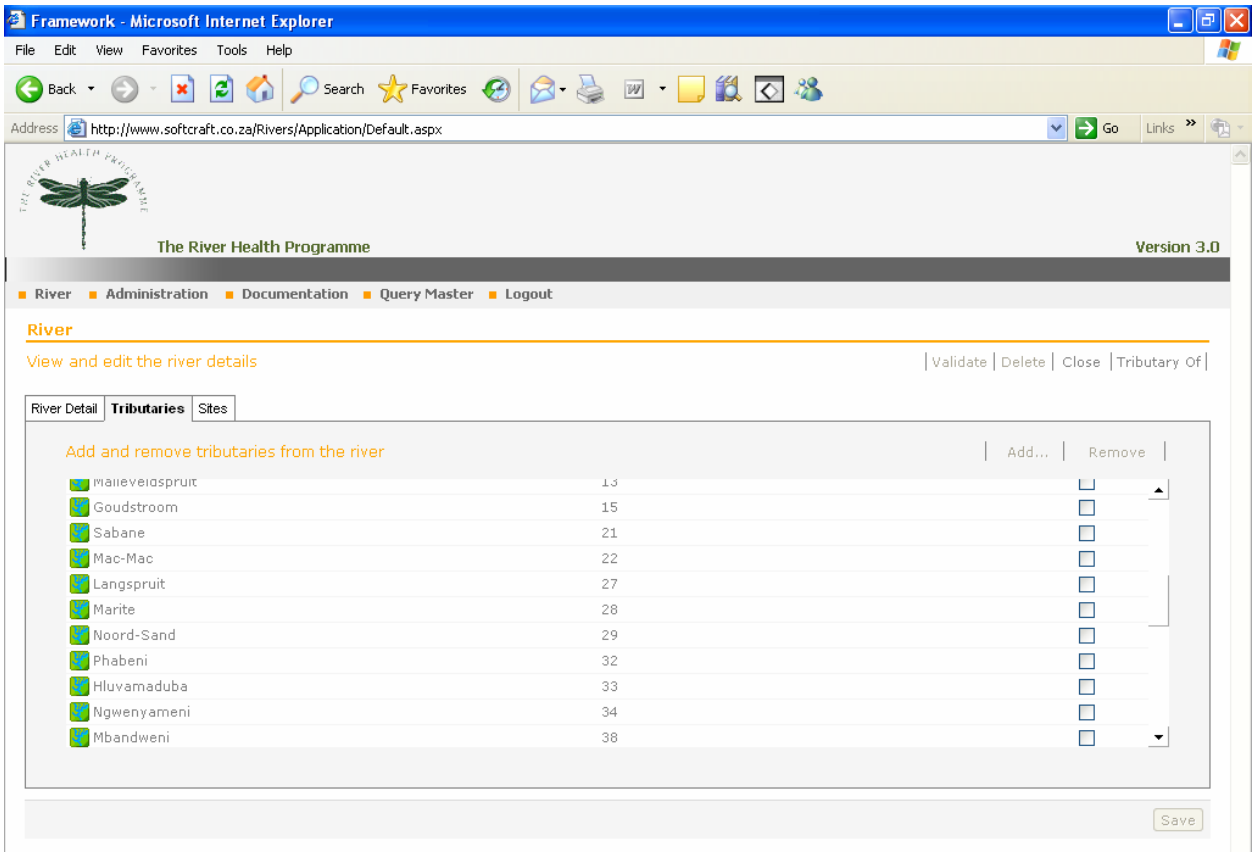
Screen 3.1 Checking for existing rivers on the Rivers Server



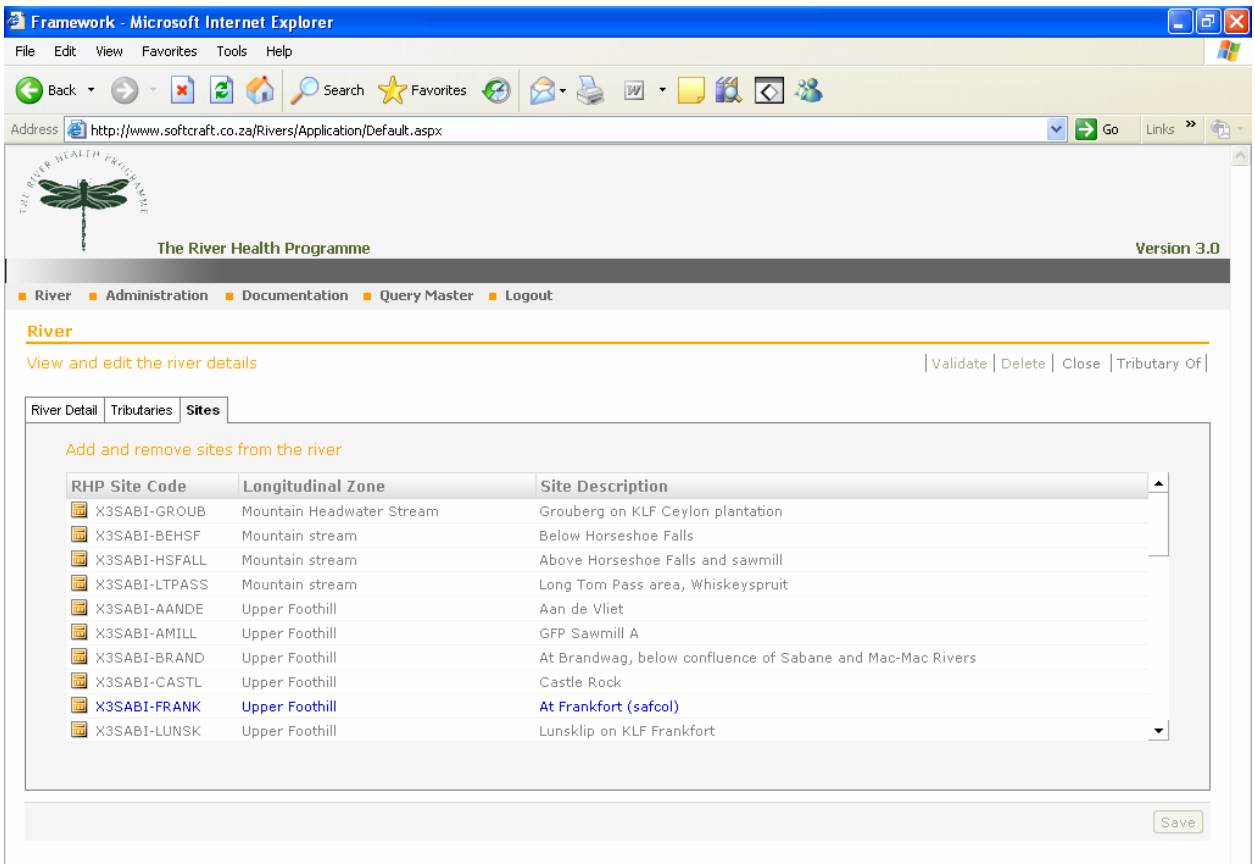
Screen 3.2 Creating a new river and notifying the Rivers Administrator to ensure river validation



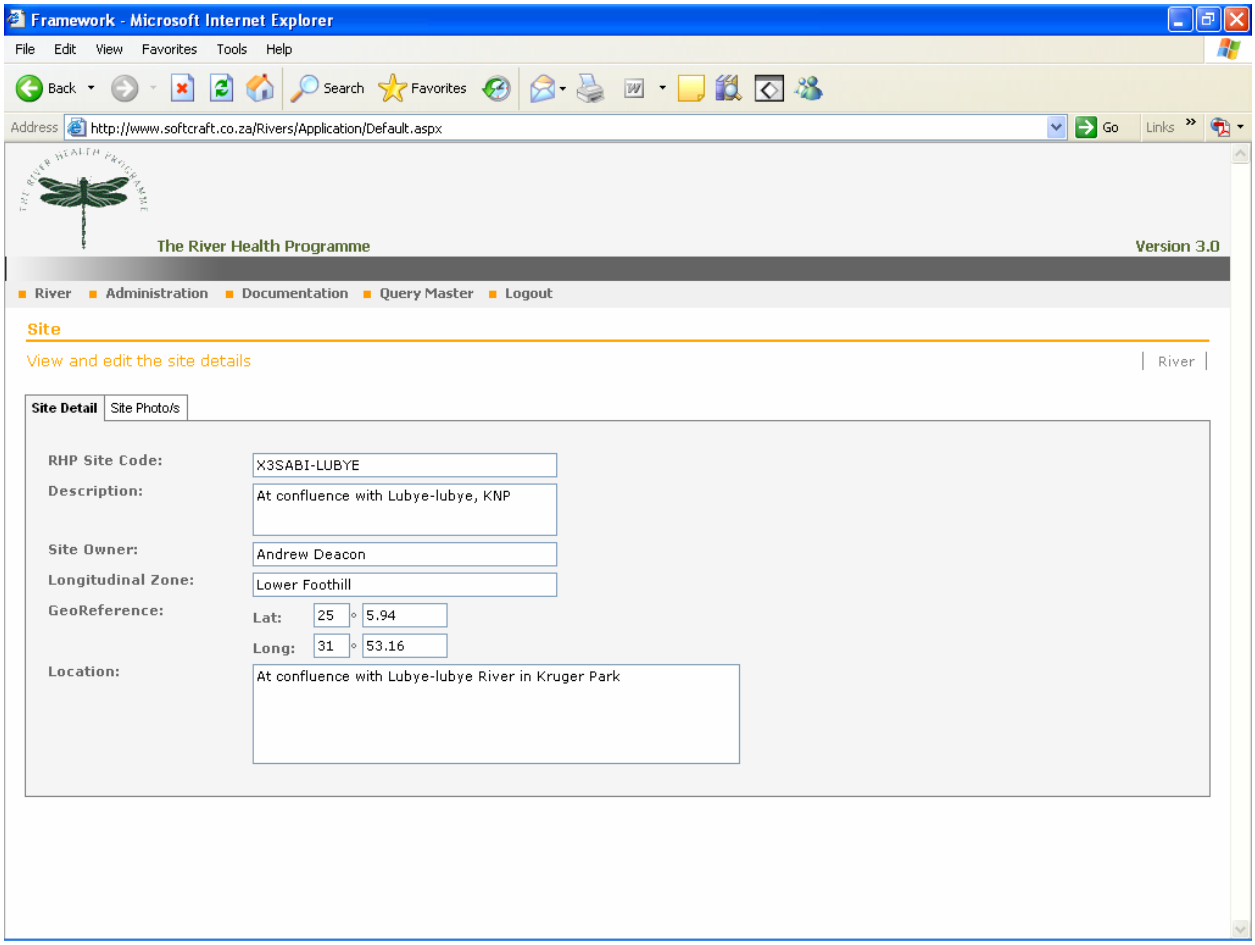
Screen 3.3 Viewing details of a river



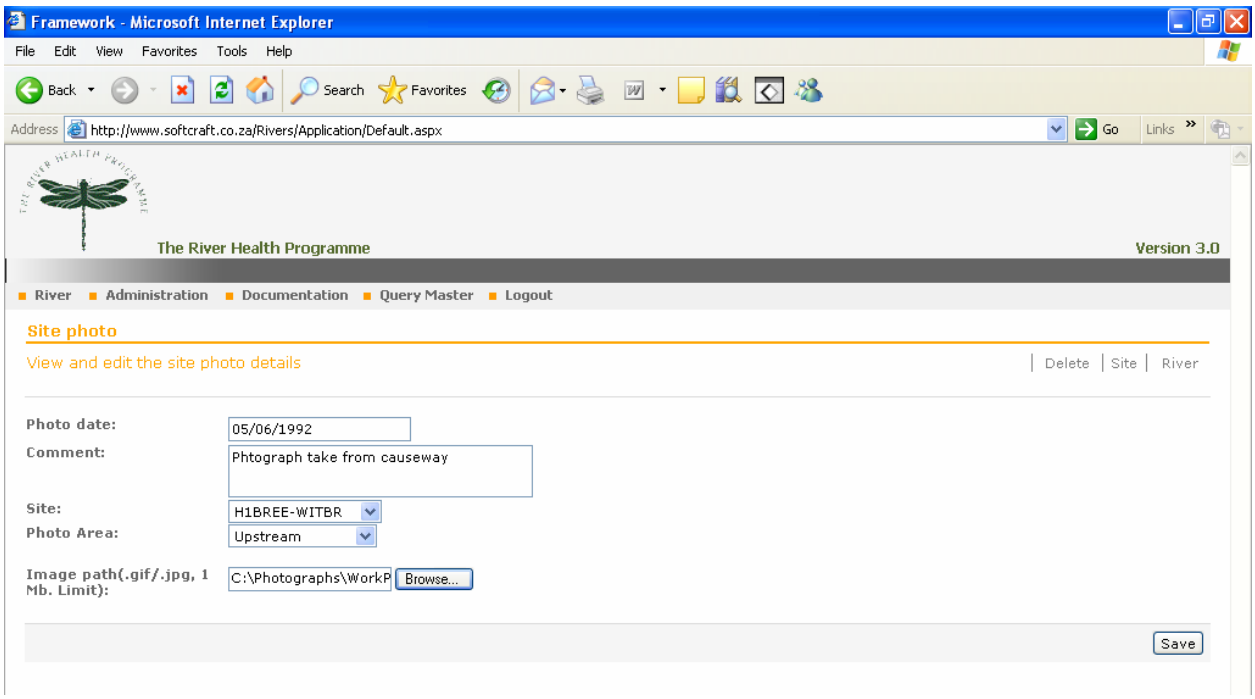
Screen 3.4 Viewing tributaries of a river


Framework - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://www.softcraft.co.za/Rivers/Application/Default.aspx
Go Links
The River Health Programme
Version 3.0
River Administration Documentation Query Master Logout
River
View and edit the river details
Validate Delete Close Tributary Of
River Detail Tributaries Sites
Add and remove sites from the river
RHP Site Code
Longitudinal Zone
Site Description
X3SABI-GROUB Mountain Headwater Stream Grouberg on KLF Ceylon plantation
X3SABI-BEHSF Mountain stream Below Horseshoe Falls
X3SABI-HSFALL Mountain stream Above Horseshoe Falls and sawmill
X3SABI-LTPASS Mountain stream Long Tom Pass area, Whiskeyspruit
X3SABI-AANDE Upper Foothill Aan de Vliet
X3SABI-AMILL Upper Foothill GFP Sawmill A
X3SABI-BRAND Upper Foothill At Brandwag, below confluence of Sabane and Mac-Mac Rivers
X3SABI-CASTL Upper Foothill Castle Rock
X3SABI-FRANK Upper Foothill At Frankfort (safcol)
X3SABI-LUNSK Upper Foothill Lunsklip on KLF Frankfort
Save

Screen 3.5 Viewing sites on a river – the longitudinal zone and a description are provided



Screen 3.6 Viewing site details



Screen 3.7 Uploading photographs to a site

4. RIVERS CLIENT

Sections A, B and C of the Rivers Client (Figure 4.1) form the main body of the Rivers Database for the inclusion of information which both characterises a site and provides information for the assessment of the condition of a river at a particular site at a given time. The field datasheets for the collection of river health data form the basis for the design of this component of the Rivers Database and a full description of some of the information included in the database has been taken from the associated site characterisation manual (Dallas 2005). Sections A, B and C vary with regard to the nature of information entered and the frequency of assessment as follows:

	Type of information	**Frequency of assessment**
Section A	Site specific information	Entered during or after the first site visit
Section B	Site visit information	Entered during the first site visit, checked and reassessed on each site visit
Section C	Site visit information	Assessed during each site visit

4.1. Using the River Tree View to navigate to Sites and Site Visits

The Rivers Client provides the user with an efficient mechanism to locate sites and site visit data. This involves searching for either sites or rivers, loading and navigating (either up or down) the River Tree View that is associated with the selected river/site, and selecting the required site and/or site visit from the available lists. Once the relevant site or site visit has been found, the user can view (and potentially edit depending on ownership) the data for the selected site and/or site visit. The process always starts on one of the two search forms i.e. river or site search form. The forms can be pinned (always visible) or unpinned (forms available via tags on the left of the screen and automatically hidden when the user navigates off the form). Common search criteria (e.g. river name, site name, drainage region) are provided by default, as well as whether the river is a tributary or a main river (not a tributary of any river). Additional criteria (e.g. water management area) are available if a more refined search is required. Search criteria are cleared after each search. Search results, either sites or rivers, are displayed in alphabetical

order below the search criteria. Selecting a river or site from the list results in the associated river (and all its tributaries) being loaded in a River Tree View. The user can navigate through the river hierarchy and load any of the rivers (including the parent of the original river) into its own River Tree View. The River Tree View allows any river in the hierarchy to be sorted in “alphabetical” or "source to sea" order. Selecting a river in the River Tree View loads all the sites located on that river into a site list next to the River Tree View. Under the site list, a list of site visits linked to the selected site is displayed. Selecting either site or site visit results in the associated date capture forms being displayed in a new tab.

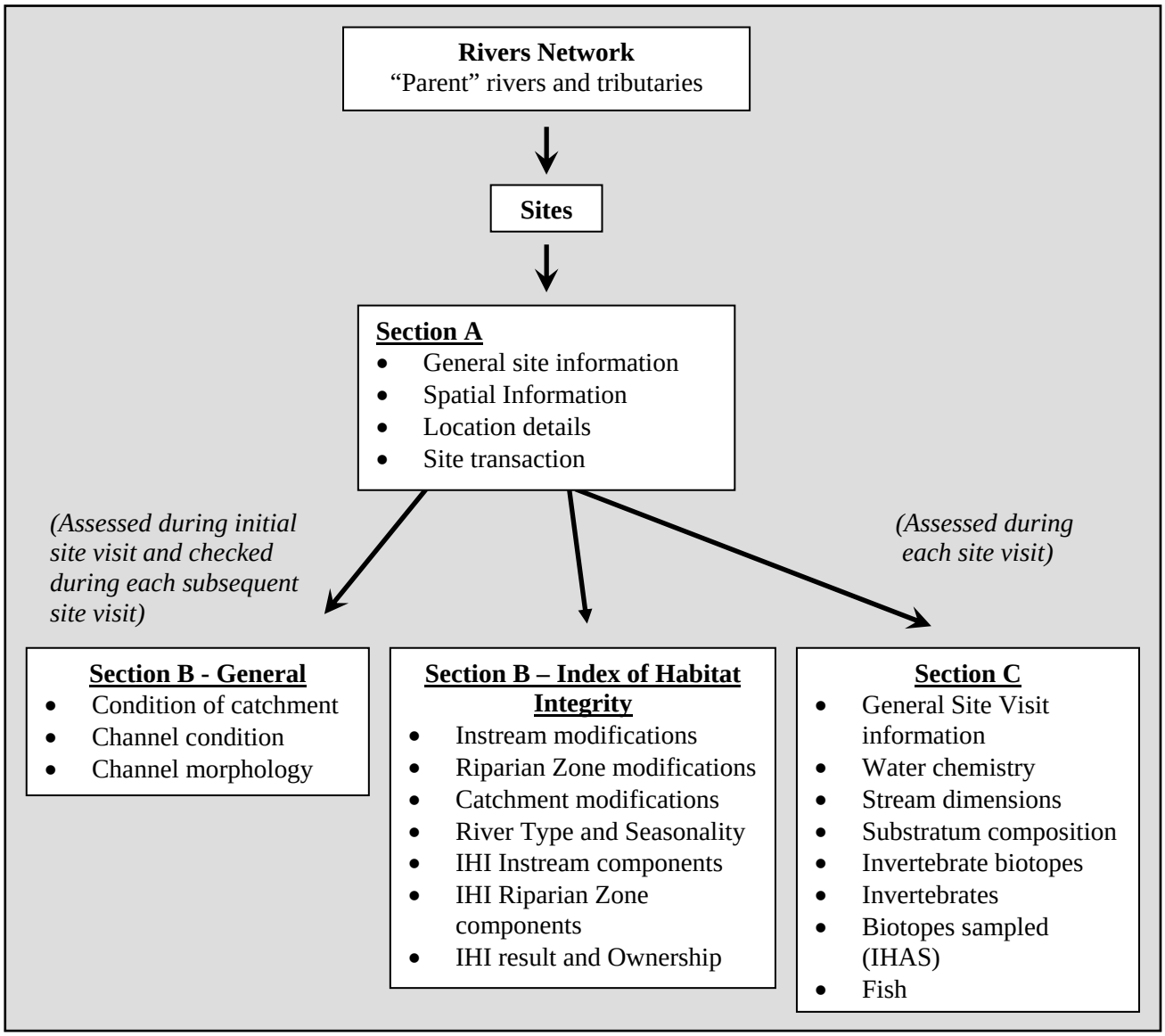


Figure 4.1 Schematic representation of the various components included in the Rivers Database 2007

Step 1: Searching by River or Site (Screen 4.1)

- Click one of the tabs on the left border to open either the site or river search form. The tabs will automatically retreat to the left hand margin when the mouse moves off the tab. To prevent the tab from automatically minimising, click the ‘Pin’ icon at the top right corner of the search form. The search form will then remain on the screen.
- Enter search criteria. If required, expand the 'Extended Search Criteria" by clicking the down arrow to refine the search
- Choose whether to search only for main rivers (rivers without tributaries) using the radio buttons

- Click "Find"
- Find the site or river in the list
- Double click on the selected site or river (or right click and "Explore" on the pop-up menu).
- Navigate through the River Tree View to find the river.

Step 2: Navigating the River Tree View (Screen 4.2)

- Once a river network has been loaded into the River Tree View, click the “plus” icon to the left of the river name of a given “parent” river to expand the tributaries of that river. To reverse the operation and contract the tributaries click on the “minus” sign next to the appropriate river.
- Continue expanding each river in the hierarchy until the desired river has been found.
- Click a river to load a list of sites located on the river
- Right-click a river and select the desired sort order of the river and its tributaries. Select either the “Order by name” order or “Order by sequence” which sorts the river and its tributaries either alphabetically or in the order of occurrence from "source to sea" along a parent river respectively.
- Right click the river and select “Explore parent” from the pop-up menu to explore the “parent” of a given river in a new tab. If the “Explore parent” option is grayed out, a “parent” does not exist for the river.

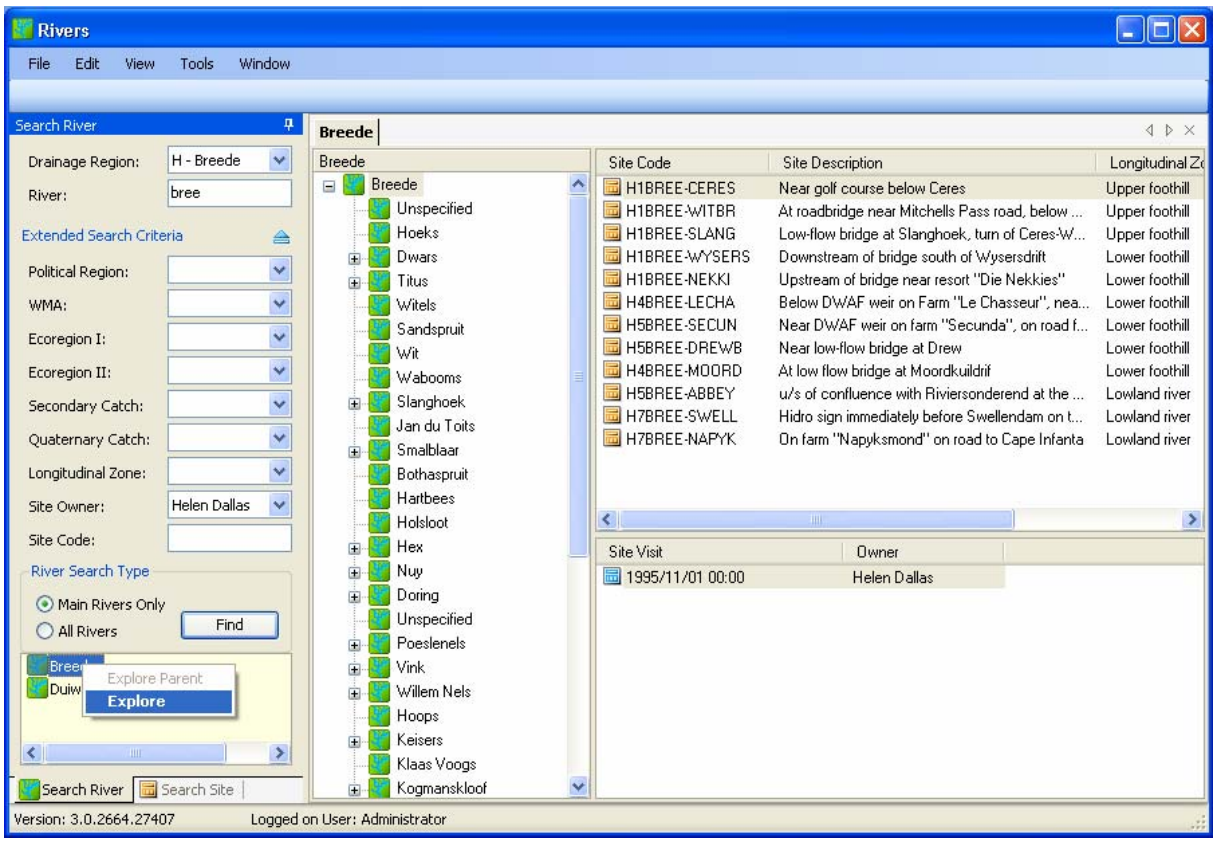
Step 3: Add, edit or delete a Site (Screen 4.3)

- Click the river in the River Tree View to view a list of sites on the river.
- Click a site to view a list of site visits associated with the site (or right-click and select ‘View/Edit’ from the context menu).
- Double-click a site to load the site form to view/edit the site information.
- Add a new site or delete a selected site by selecting ‘Edit’ from the main menu and selecting ‘Add’ or ‘Delete’ (or right-click and select ‘Add’ or ‘Delete’ from the context menu). The ‘Delete’ option is only available to the site owner.

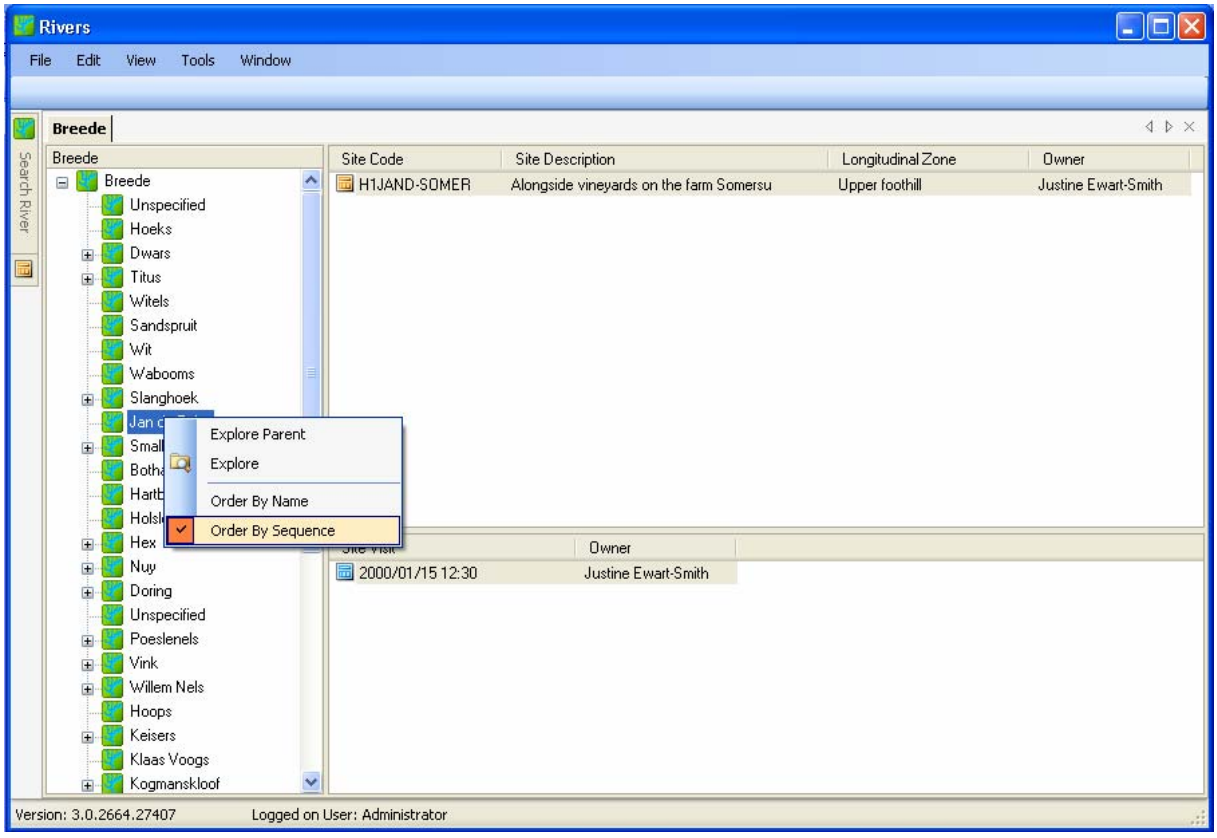
NB: When adding a new site, it is compulsory to add the Georeference (latitude and longitude), Site description and Longitudinal Zone. If these are not completed the site cannot be saved. If the site is within 500m of an existing site, the user is warned to check that it is indeed a new site). This avoids unnecessary site duplication.

Step 4: Add, edit or delete a Site Visit (Screen 4.4)

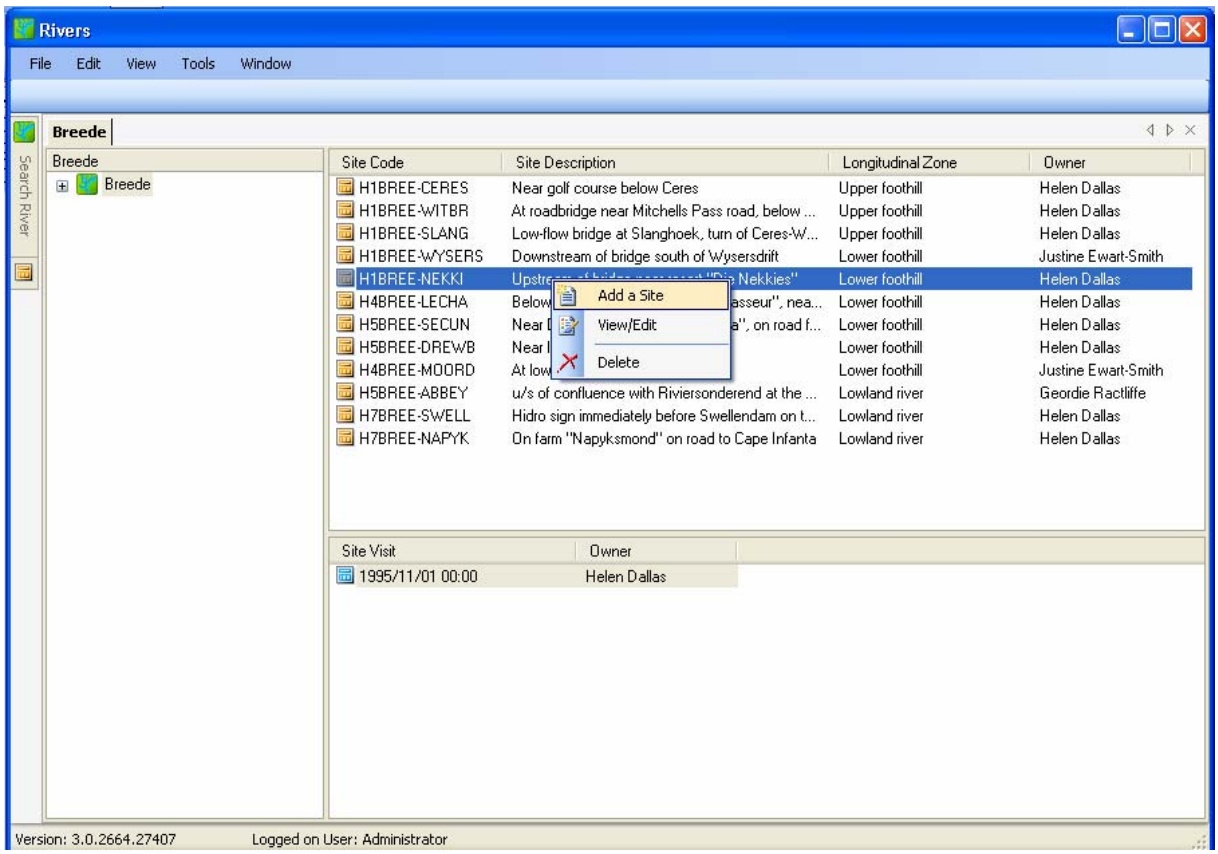
- Click a site in the site list to view a list of site visits associated with the site.
- Double-click a site visit in the list to load the site visit form to view/edit the site visit information.
- Add a new site visit or delete a selected site visit by selecting ‘Edit’ from the main menu and selecting ‘Add’ or ‘Delete’ (or right-click and select ‘Add’ or ‘Delete’ from the context menu). The ‘Delete’ option is only available to the site visit owner.



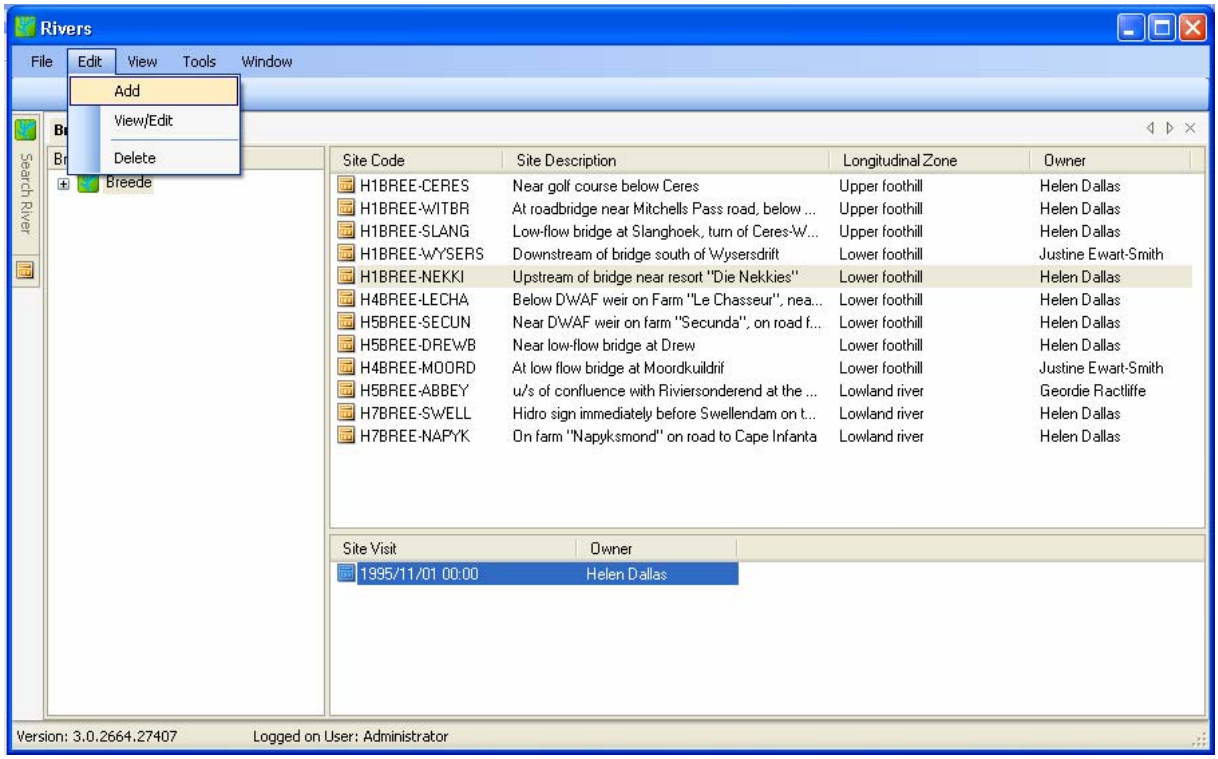
Screen 4.1 Searching for a river using the extended search criteria



Screen 4.2 Sorting the rivers in the tree view


Rivers
File Edit View Tools Window
Breede
Search River
Breede
Breede
Site Code
Site Description
Longitudinal Zone
Owner
H1BREE-CERES Near golf course below Ceres Upper foothill Helen Dallas
H1BREE-WITBR At roadbridge near Mitchells Pass road, below ... Upper foothill Helen Dallas
H1BREE-SLANG Low-flow bridge at Slanghoek, turn of Ceres-W... Upper foothill Helen Dallas
H1BREE-WYSERS Downstream of bridge south of Wysersdrift Lower foothill Justine Ewart-Smith
H1BREE-NEKKI Lower foothill Helen Dallas
H4BREE-LECHA Lower foothill Helen Dallas
H5BREE-SECUN Lower foothill Helen Dallas
H5BREE-DREWB Lower foothill Helen Dallas
H4BREE-MOORD Lower foothill Justine Ewart-Smith
H5BREE-ABBEY u/s of confluence with Riviersonderend at the ... Lowland river Geordie Ractliffe
H7BREE-SWELL Hidro sign immediately before Swellendam on t... Lowland river Helen Dallas
H7BREE-NAPYK On farm "Napyksmond" on road to Cape Infanta Lowland river Helen Dallas
Add a Site
View/Edit
Delete
Site Visit
Owner
1995/11/01 00:00 Helen Dallas
Version: 3.0.2664.27407
Logged on User: Administrator

Screen 4.3 Adding a site in the Site List


Rivers
File Edit View Tools Window
Add
View/Edit
Delete
Search River
Breede
Site Code
Site Description
Longitudinal Zone
Owner
H1BREE-CERES Near golf course below Ceres Upper foothill Helen Dallas
H1BREE-WITBR At roadbridge near Mitchells Pass road, below ... Upper foothill Helen Dallas
H1BREE-SLANG Low-flow bridge at Slanghoek, turn of Ceres-W... Upper foothill Helen Dallas
H1BREE-WYSERS Downstream of bridge south of Wysersdrift Lower foothill Justine Ewart-Smith
H1BREE-NEKKI Upstream of bridge near resort "Die Nekkies" Lower foothill Helen Dallas
H4BREE-LECHA Below DWAF weir on Farm "Le Chasseur", nea... Lower foothill Helen Dallas
H5BREE-SECUN Near DWAF weir on farm "Secunda", on road f... Lower foothill Helen Dallas
H5BREE-DREWB Near low-flow bridge at Drew Lower foothill Helen Dallas
H4BREE-MOORD At low flow bridge at Moordkuildrif Lower foothill Justine Ewart-Smith
H5BREE-ABBEY u/s of confluence with Riviersonderend at the ... Lowland river Geordie Ractliffe
H7BREE-SWELL Hidro sign immediately before Swellendam on t... Lowland river Helen Dallas
H7BREE-NAPYK On farm "Napyksmond" on road to Cape Infanta Lowland river Helen Dallas
Site Visit
Owner
1995/11/01 00:00 Helen Dallas
Version: 3.0.2664.27407
Logged on User: Administrator

Screen 4.4 Adding a site visit from the main menu

4.2. Viewing and adding Site data: Section A

When a site is selected from the list, the general site information form is loaded by default into a new tab. The site and site visit list are still open in their original tab, allowing the user to open multiple sites at the same time. The tab can be closed by clicking on the "x" in the right hand corner. Section A contains three forms which display general information about a site and a fourth form which summarises any changes made to this information. Each of the forms are available via a vertical toolbar on the left hand site of the form (Screen 4.5). Section A includes the following forms:

- General Site information
- Spatial Information
- Location Details
- Site Transactions

Site Header: A header with information about the current user, the organisation to which the user is affiliated and the "owner" of the data, as well as the RHP Site Code remains visible at the top of the screen as one clicks through each screen in this section.

(a) General Site information (Screen 4.5)

General site information includes information that characterises the site. Each field is described briefly below and the reader is referred to the glossary or Dallas (2005) if additional clarification is required. In all cases data are either added directly by typing in the free text boxes or by selecting from the appropriate drop-down list. Some fields are compulsory (indicated with an * in the manual).

- Owner: The owner of the site data (often the Regional Champion)
- RHP Site Code*: A standardised unique site code is allocated to each site (secondary Catchment code, first four letters of river name, first five letters of location/farm name etc.) For example G1EERS-JONKE is the Eerste River in the Jonkershoek Forestry Reserve. A duplicate site code will not be accepted and will require the user to modify the site code by changing the location component of the code when adding a new site.
- Old Site Code: Previous code(s) used for the site
- Reference Site: Ticked if the site is a reference site
- Project Site Number: Project-specific site number (for mapping purposes)
- River: name of river assessed
- Tributary of: name of the parent of the current river. This is important in cases where river names are common and rivers of the same name may occur in different catchments.
- Latitude and Longitude*: three different formats for longitude and latitude co-ordinates are available in the database i.e. conventional format (degree/minutes/seconds), GPS format (degrees and minutes+seconds) and GIS format (decimal degrees). Data may be entered in conventional, GPS or GIS format by selecting the format using the appropriate radio button and entering the values in the appropriate fields. Other formats are then calculated automatically and records are stored automatically.
- Other sites within 500m: all other sites within 500m of the current site are listed automatically. This is aimed at minimising site duplication and ensures the user is aware of other sites in close proximity.
- Site Description*: details of site location, e.g. farm name, road, bridge, village, etc.
- Map Reference: either 1: 250 000 or 1: 50 000.

- Longitudinal Zone*: longitudinal zone within which the site falls.
- Site Length: length of river being assessed.
- Altitude: altitude of the site.
- Hydrological Type (natural and present day): based on the following types: perennial, seasonal or ephemeral.
- Associated Systems: important systems associated with the site or river (e.g. wetlands or estuaries)
- Distance: of associated system from the site.
- Associated System Name: name of associated system
- Additional Comment: Any additional information that may be pertinent to the site that has not been included in the forms.

(b) Spatial Information (Screen 4.6)

Spatial data are populated intermittently via the Rivers Server. To facilitate this all RHP sites are plotted in GIS and intersected against the various spatial covers such as political region, WMA, Ecoregion, Geological type, etc. This task is undertaken by the Rivers Administrator. **GIS coverages are also provided on the Rivers Database CD to assist users in populating the spatial data.** Site Owners are also able to populate these fields using drop-down lists.

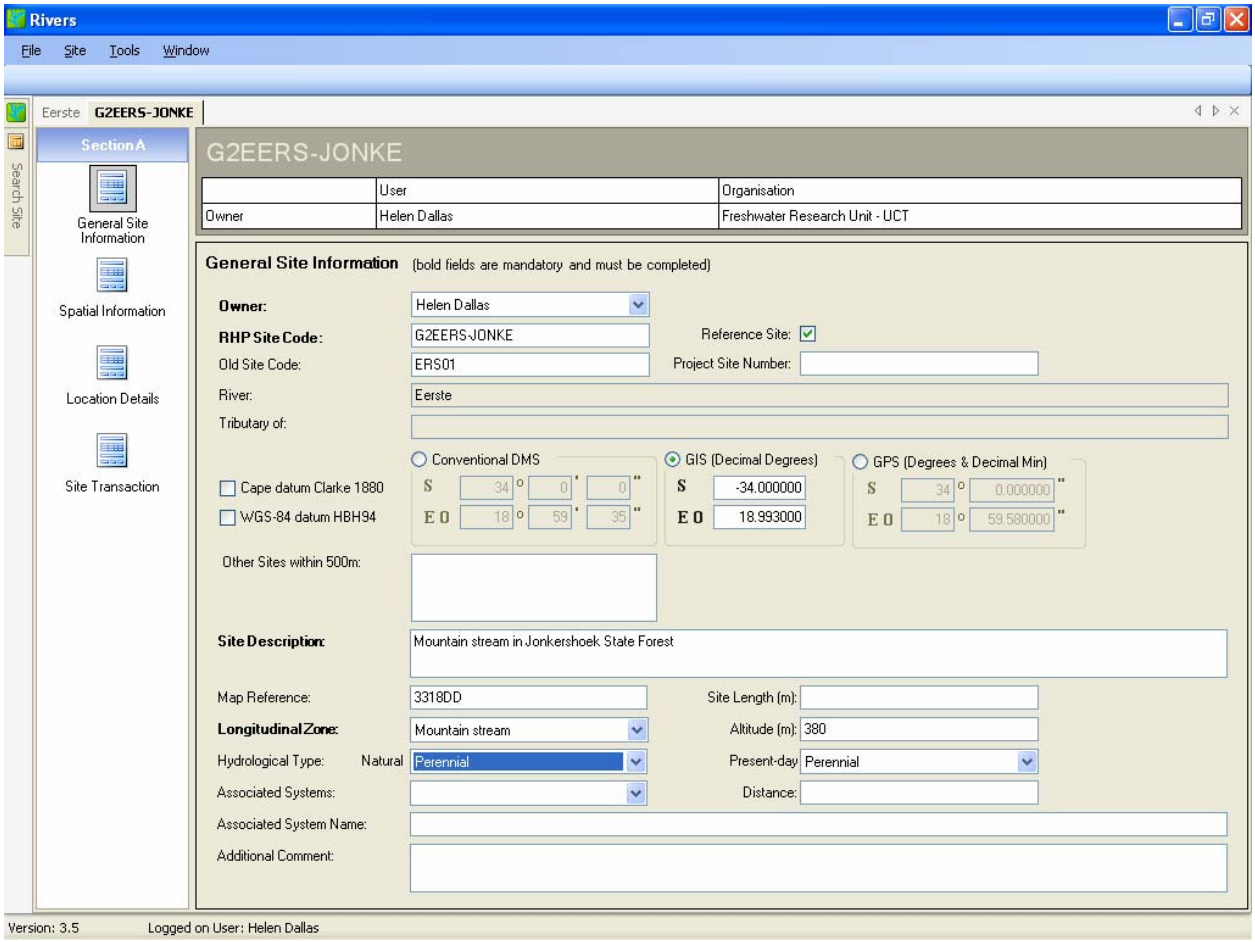
- Drainage Region: drainage region of current river
- Political Region: One of nine regions.
- Water Management Area: DWAF's 19 water management areas.
- Ecoregion Level I: One of 31 as identified in Kleynhans *et al.* (2005).
- Ecoregion Level II: One of 135 as identified in Kleynhans *et al.* (2007a).
- Secondary Catchment Code: DWAF secondary drainage region.
- Quaternary Catchment Code: DWAF quaternary drainage region.
- Water Chemistry Management Region: One of seven as identified in Day *et al.* (1998).
- Vegetation Type: Based on Low and Rebelo's (1996) potential natural vegetation of South Africa, Lesotho and Swaziland.
- Geological Type: Based on Vegter's (1995) simplified lithostratigraphic units.
- Contour Range: Altitude range within which site falls - estimated from a 1:50 000 map.
- Source Distance: Distance from source of river estimated from a 1: 50 000 map or extracted from the table which is included as a table in the rivers coverage).
- Rainfall Region: Season in which the majority of rain falls.
- Stream Order: Order estimated of 1: 50 000 map using the Strahler method.
- DWAF Gauging Station: the presence of a DWAF gauging station is indicated. If present, the greyed boxes become active and the DWAF Code and estimated distance upstream or downstream of the site is recorded.

(c) Location Details (Screen 4.7)

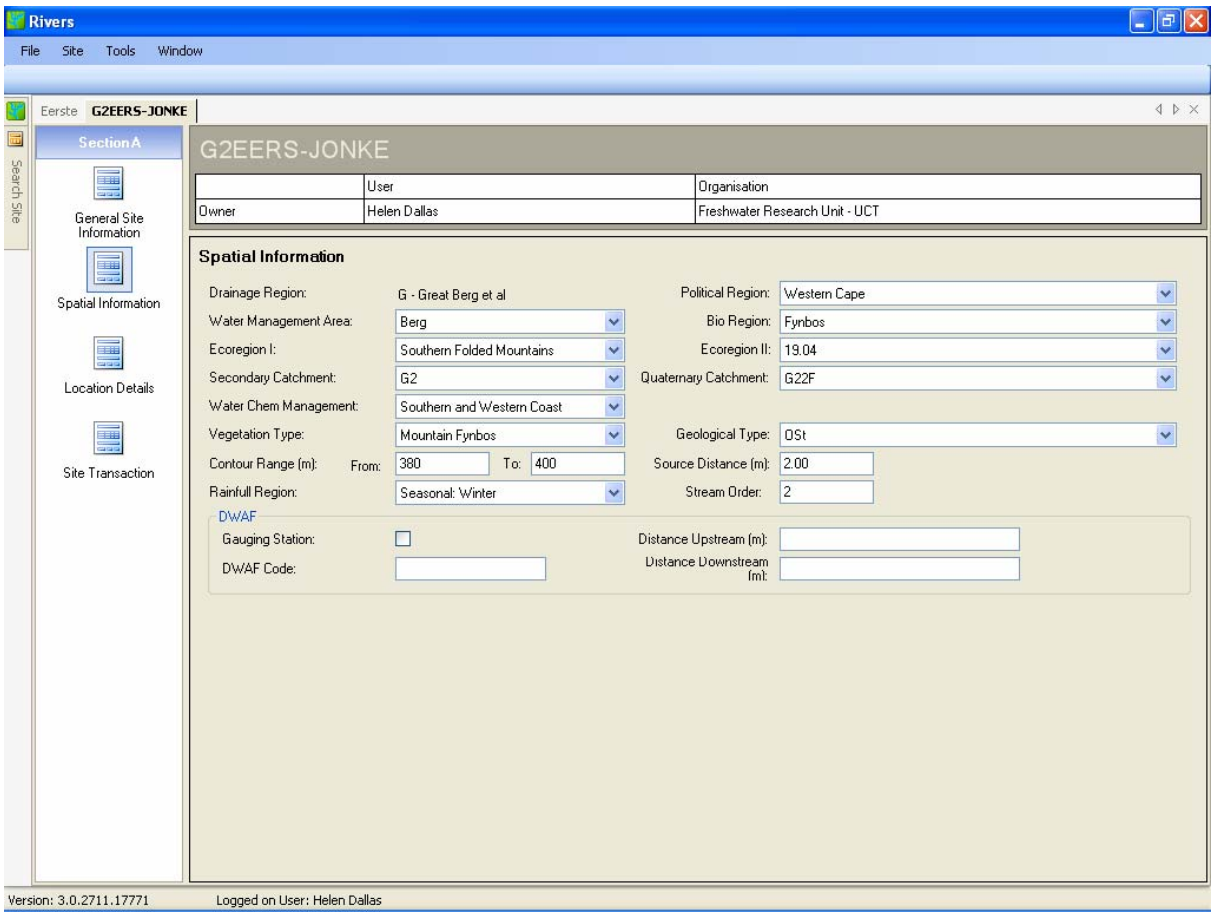
This is a descriptive form to facilitate future access to the site for biomonitors who may not have visited the site previously. The form provides a text box for entering a relatively detailed description of how to find the site and whose land must be traversed to access the site. Provision is made to indicate whether or not a permit is required, where to obtain the permit, whether or not a key is needed and where to obtain the key. If the site is on a farm, the name and farm registration code may be recorded. Extracts from 1: 50 000 topographical maps can also be used to indicate site location (See Section 3.2).

(d) Site Transaction (read-only) (Screen 4.8)

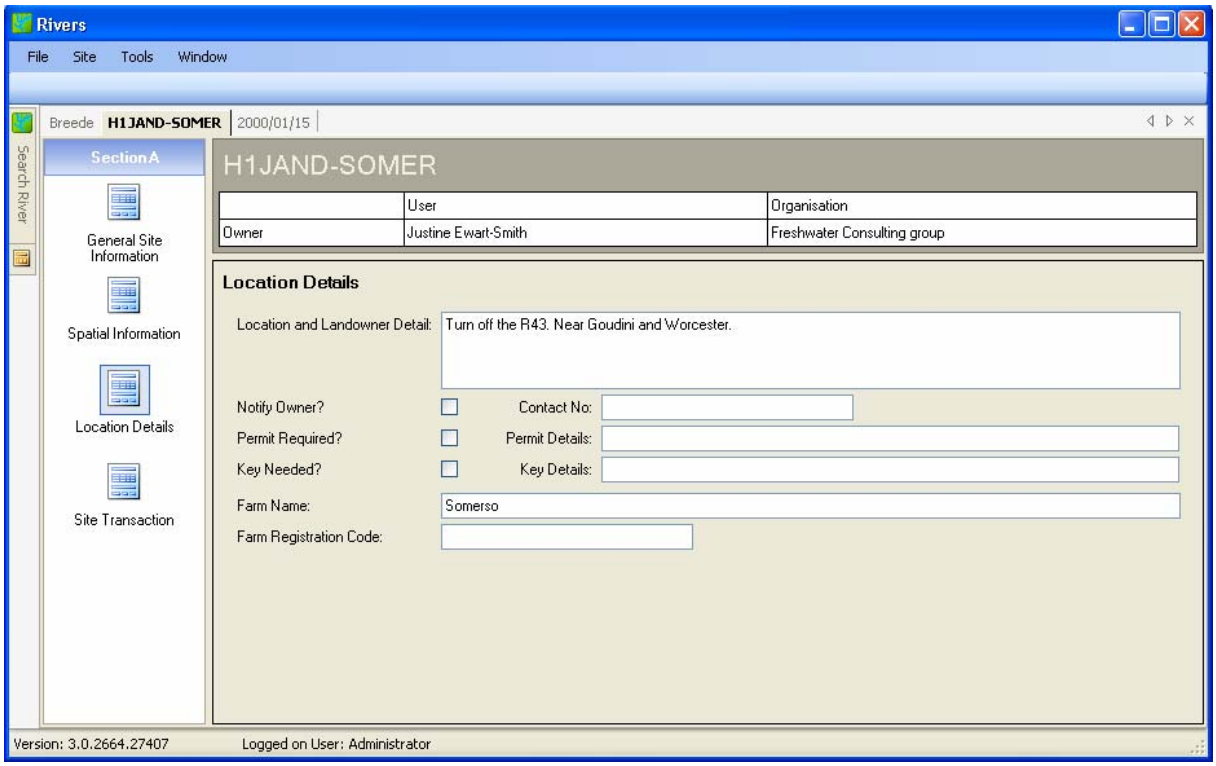
The "site transaction" form is an inventory of all changes that are made to the information entered in Section A. When a user changes information that was entered on a previous occasion in Section A, the user is asked to confirm whether the change should be made. If the user confirms these changes then the database automatically updates the Site Transaction form with these changes. The following information is recorded on this form: the field which has been changed, the information that was initially recorded for that field, the new information added to that field, the date that the changes were made, the user who is responsible for making the changes and the organisation to which the user is affiliated. In this way, a complete record is kept of any changes that may be made to the site information. Although the information included in Section A is site specific and therefore should not change over time, it is important to allow changes to be made for example if land ownership changes or improved GPS technology allows more accurate geo-referencing of a site. This form is automatically updated and cannot be edited.



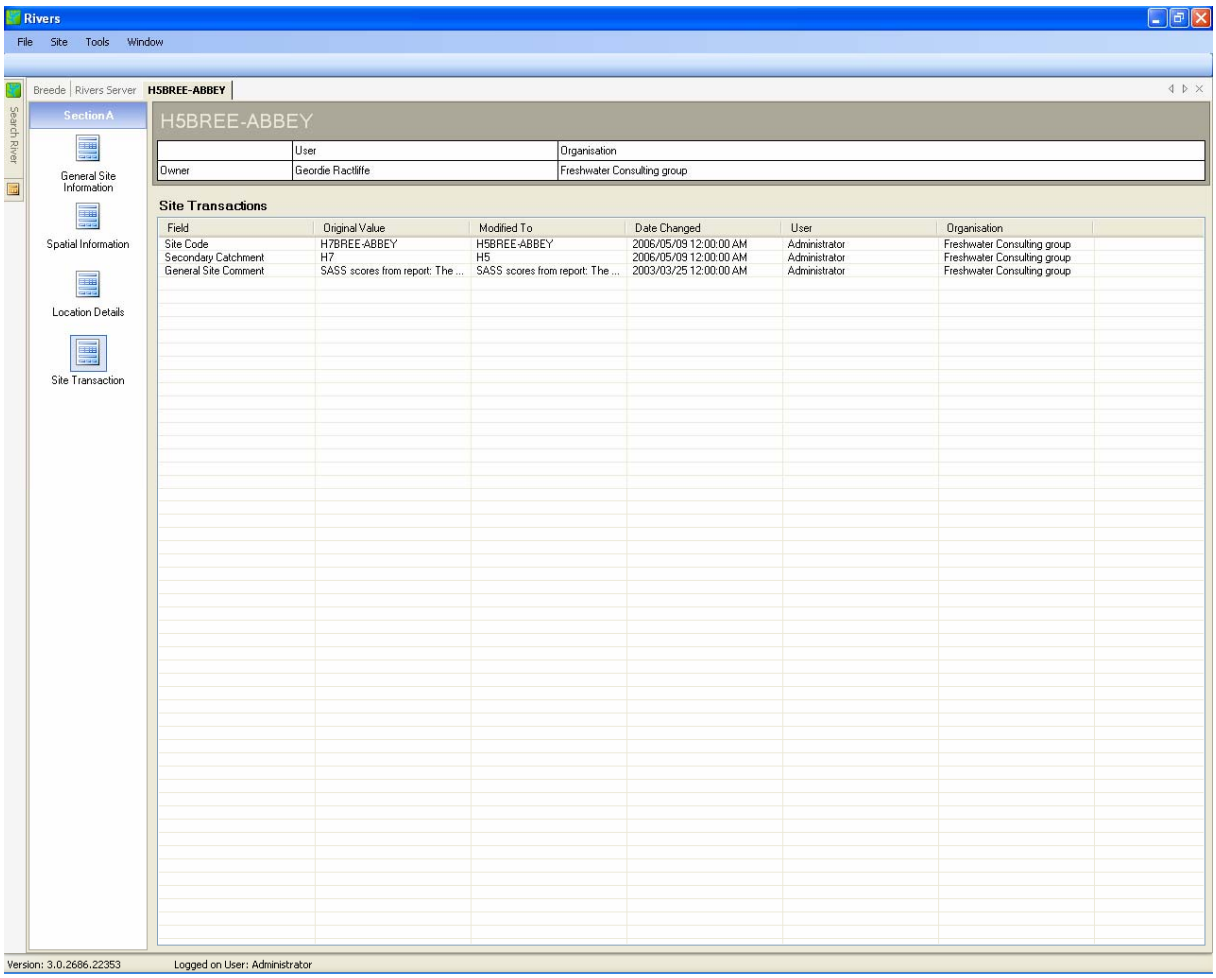
Screen 4.5 Toolbar providing access to forms in Section and General Site Information



Screen 4.6 Spatial Information



Screen 4.7 Location Detail



Screen 4.8 Site Transaction

4.3. Viewing and adding Site Visit data: Sections B and C

The following procedure outlines the steps taken when adding, viewing or editing Site Visit data for a specified site code and date. When a site is selected from the list, the site visits are listed in the Site Visit window. To view or edit a site visit double click on the Site Visit, to add a site visit, right-click and select "Add a Site Visit" (Screen 4.9). For a new site, a pop up form appears with a date and time field, and "Owner" and "Assessor" drop-down lists. The default for both is the logged in user – if different select using the list. The Site Visit information form is then loaded by default into a new tab. Each of the forms are available via a vertical toolbar on the left hand site of the form (Screen 4.10). Each field is described briefly below and the reader is referred to the glossary or Dallas (2005) if additional clarification is required. In all cases data are either added directly by typing in the free text boxes or by selecting from the appropriate drop-down list. Rating scales are used in many cases.

Rating Scale
0 - None: none in vicinity of site, no discernible impact.
1 - Limited: limited to a few localities, impact minimal.
2 - Moderate: land-use generally present, impact noticeable.
3 - Extensive: land-use widespread, impact significant, small areas unaffected.
4 - Entire: land-use 100% in area, impact significant.

Viewing and adding Site Visit data: Section B – General

Section B - General consists of forms that include fields that relate to catchment condition including land-use, channel condition and channel morphology. Components of this section are assessed during the initial site visit, and then checked and reassessed if necessary on subsequent site visits. The information is therefore site visit specific, i.e. the information is related to a specific sampling date. Information from a previous site visit can be automatically populated in the new site visit by right-clicking and selecting: "Generate from previous".

Section B - General includes the following forms:

- Condition of Catchment
- Channel Condition
- Channel Morphology

(a) Condition of Catchment (Screen 4.10)

This form includes features regarding the condition of the local catchment and land-use within the catchment. One or several land-uses are selected from the drop-down list (right click and select "Add") and the extent of each "within the riparian zone" and "beyond the riparian zone" rated depending on the level of the impact. The potential impact of each land-use on river health is estimated. A level of confidence is selected. Any specific information about each entry can be included in the free text box titled "Comments" on the form. To save, right-click and select "Save". Further land-uses may then be added. Specific data may also be exported directly by right-clicking on the relevant screen and selecting "export to excel" (see screen 4.11).

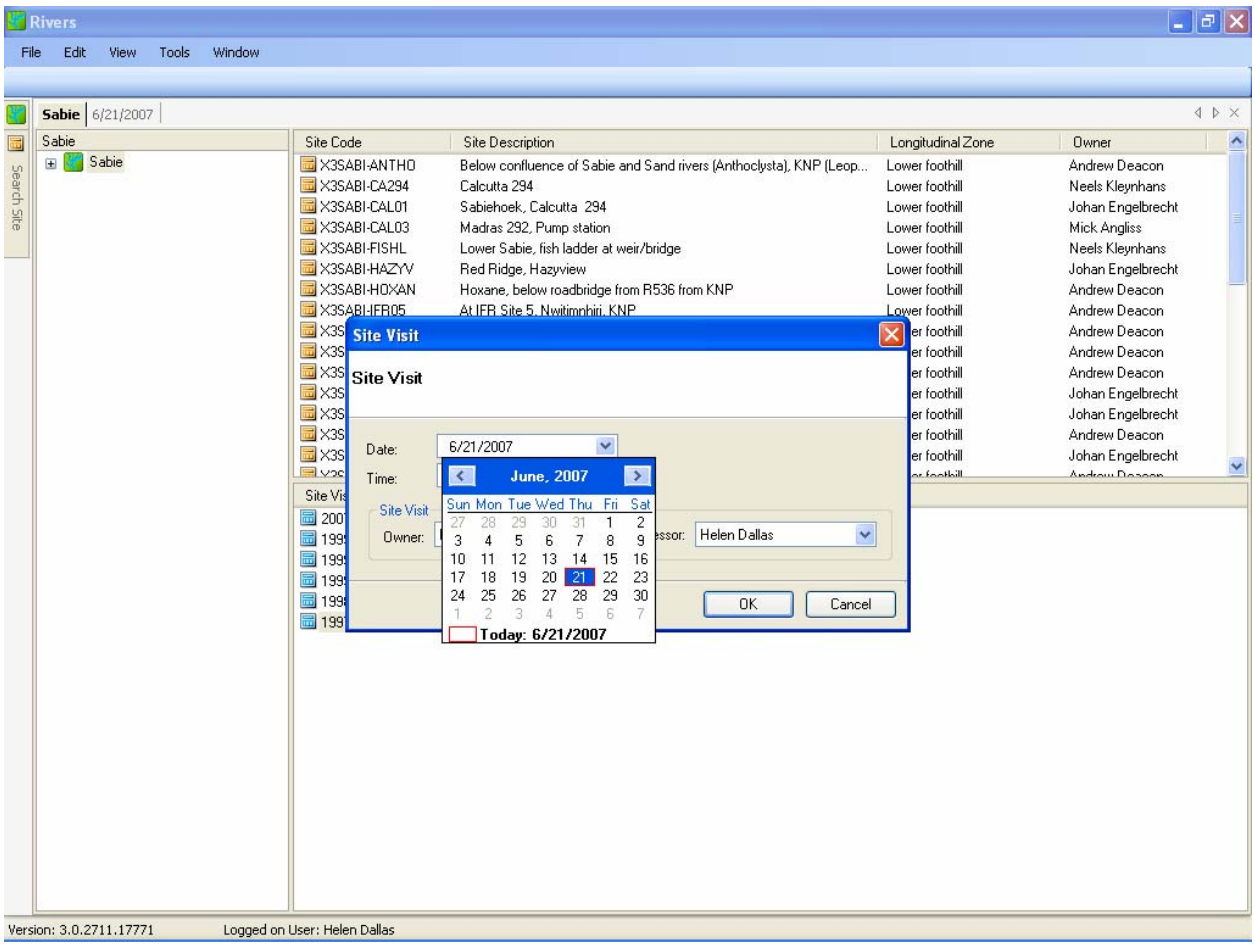
(b) Channel Condition (Screen 4.11)

In-channel and bank modifications at the sites are listed or added from the drop-down list. The extent of their impact both upstream and downstream of the site is rated and the distance of each modification upstream or downstream specified. Comments about the impact can be included in the free text box next to each modification. Adding and saving modifications follow the same process as for land-use.

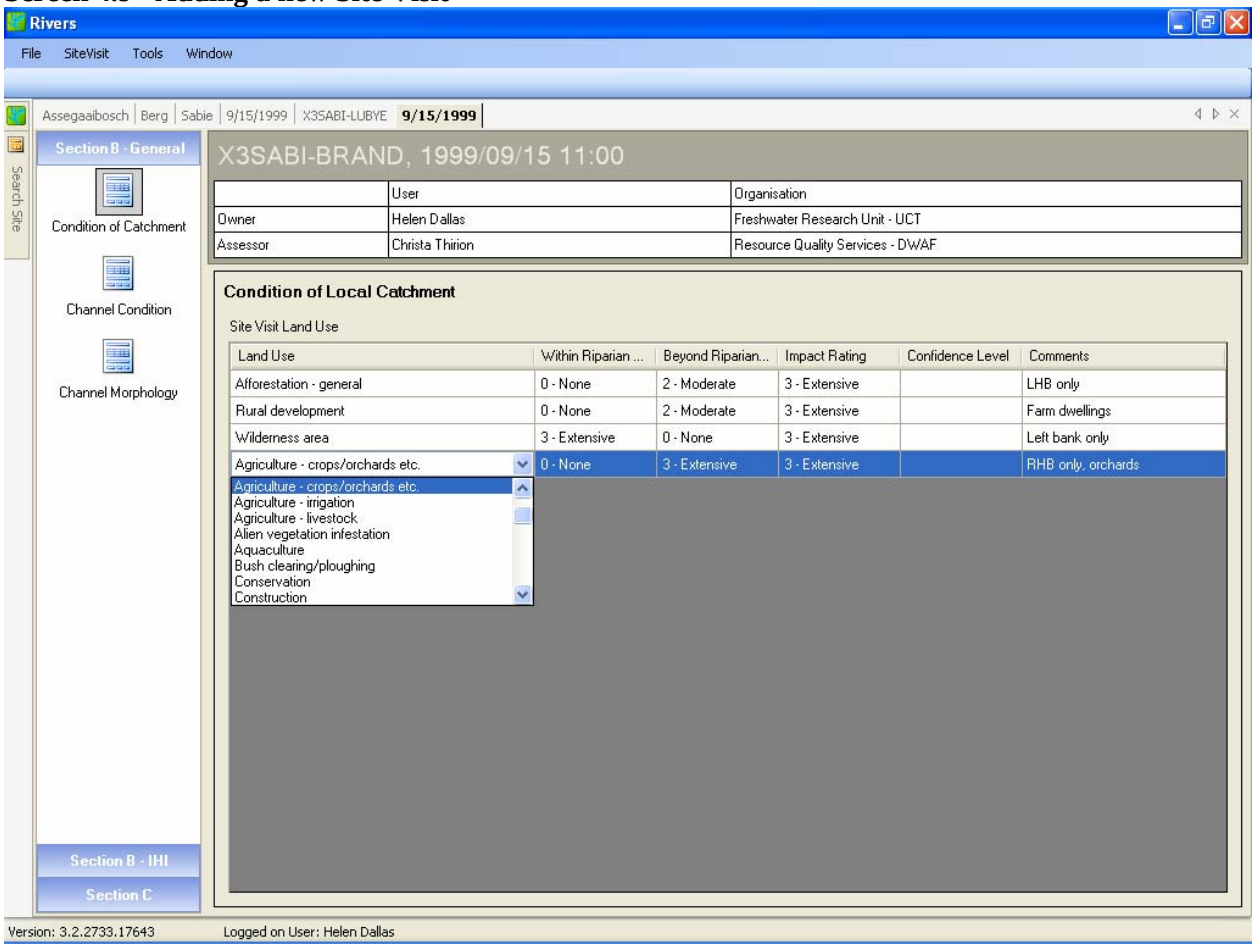
(c) Channel Morphology (Screen 4.12)

Details pertaining to the channel type and cross section are captured in this section. Channel type is selected from the drop-down list. If bedrock is selected, then no "Channel type details" are required. If either "mixed bedrock and alluvial" or "alluvial with dominant type(s)" are selected, then "Channel type details" need to be captured by right-clicking and selecting "Add". More than one substrate type may be selected. The presence of each cross-section feature is noted for both the left and right banks by clicking the appropriate box.

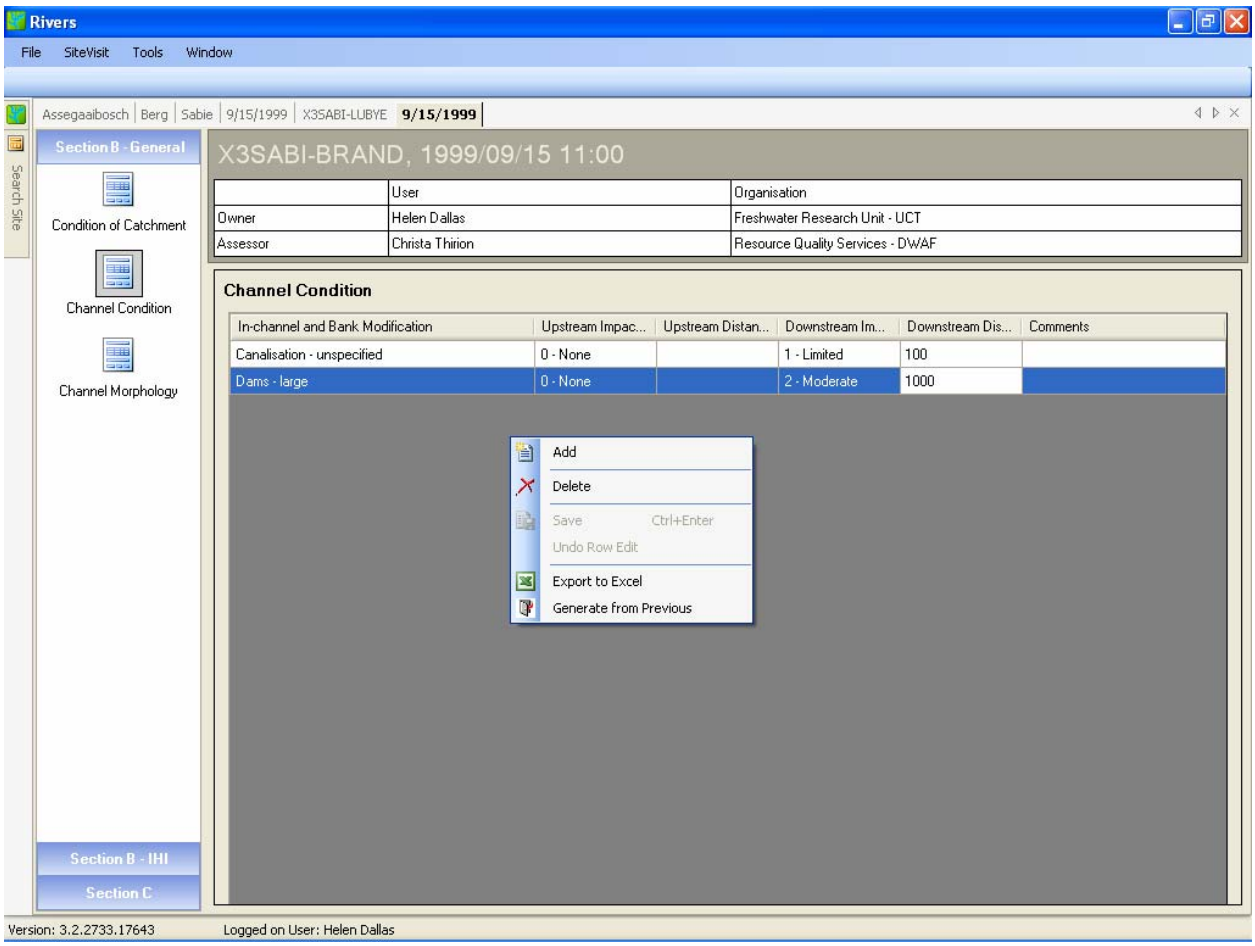
> **Hint**: If you prefer using the keyboard to capture data, use "Insert" to add a new record, type the first letter of the variable to be added, "Tab" to move from one column to another; repeat until all data are added.



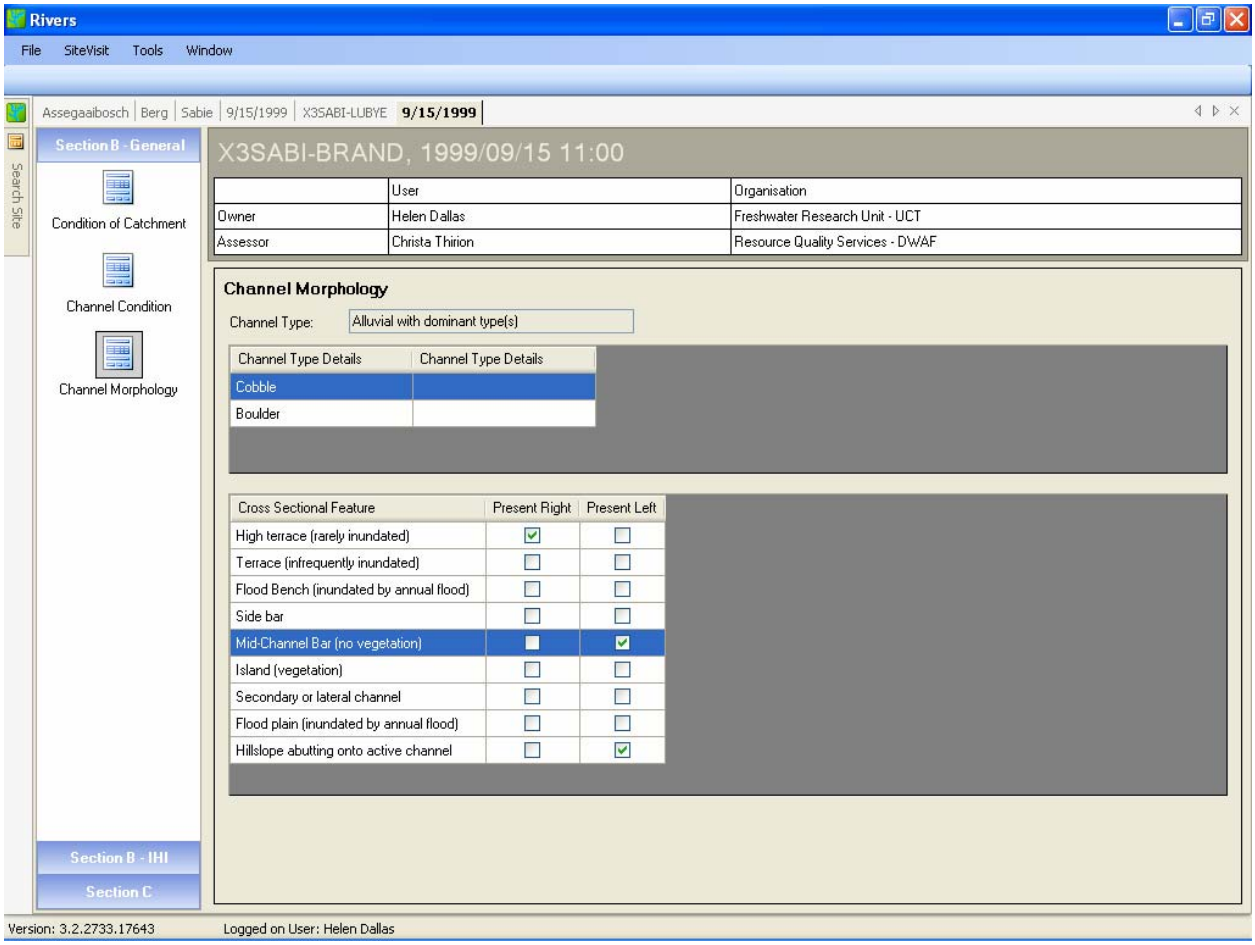
Screen 4.9 Adding a new Site Visit



Screen 4.10 Condition of Catchment



Screen 4.11 Channel Condition



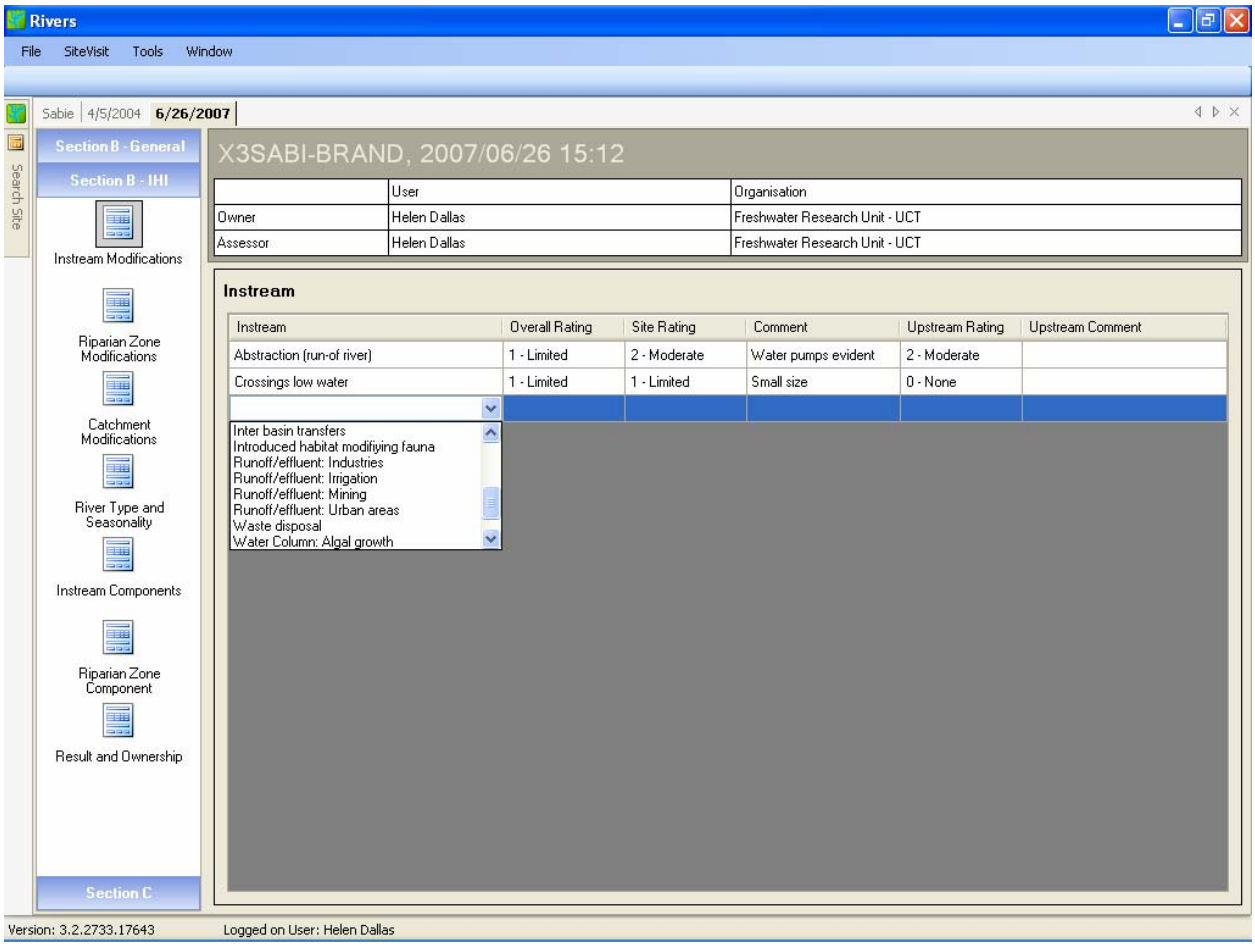
Screen 4.12 Channel Morphology

Viewing and adding Site Visit data: Section B – Index of Habitat Integrity

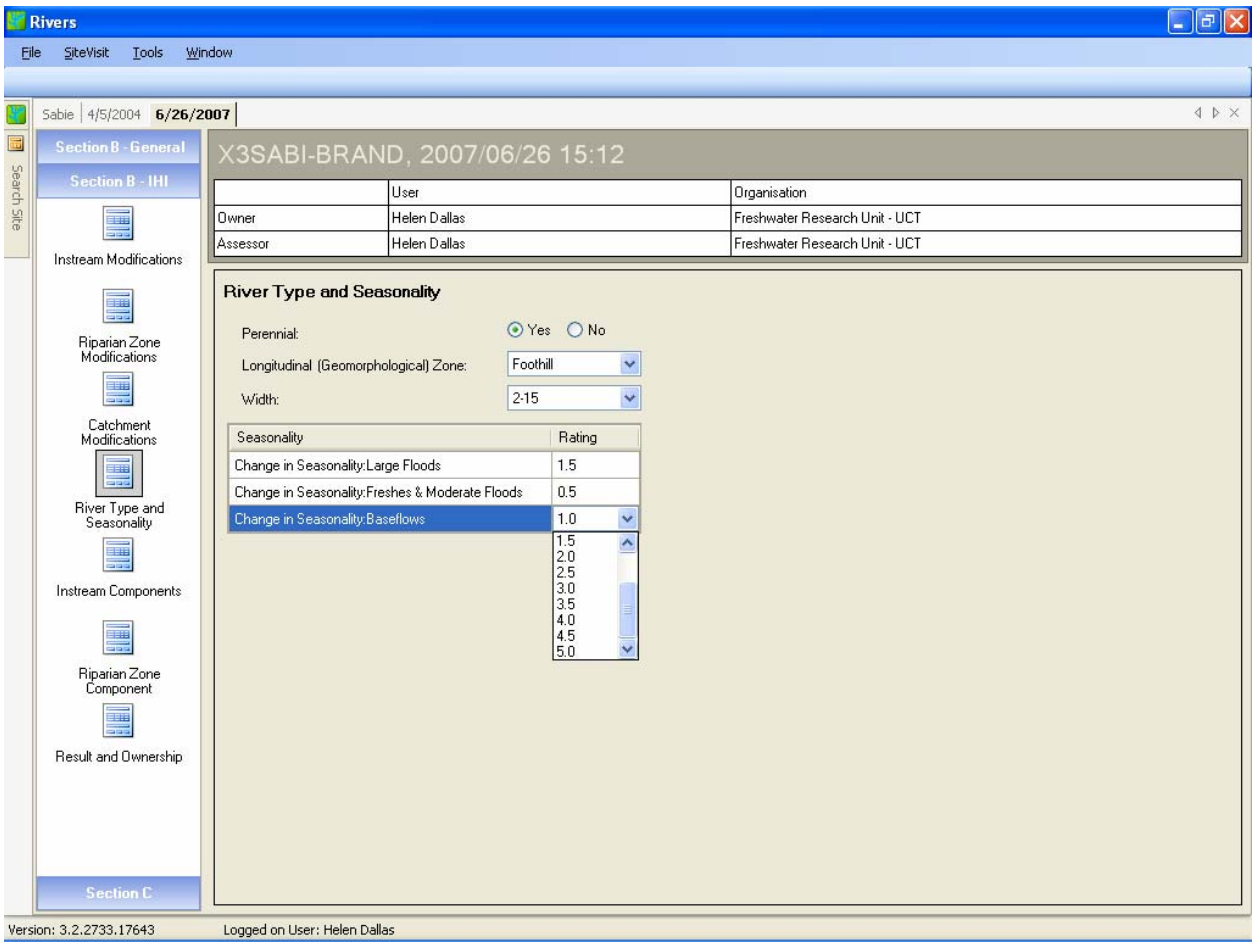
The Index of Habitat integrity is based on the recent version (Kleynhans *et al.* 2007b) developed as module G of the river ecoclassification manual for ecostatus determination (Version 2). Details are available via the RHP website (www.csir.co.za/rhp). Section B - Index of Habitat integrity includes the following forms:

- Instream Modifications
- Riparian Zone Modifications
- Catchment Modifications
- River Type and Seasonality
- IHI Instream Components
- IHI Riparian Zone Components
- Results and Ownership

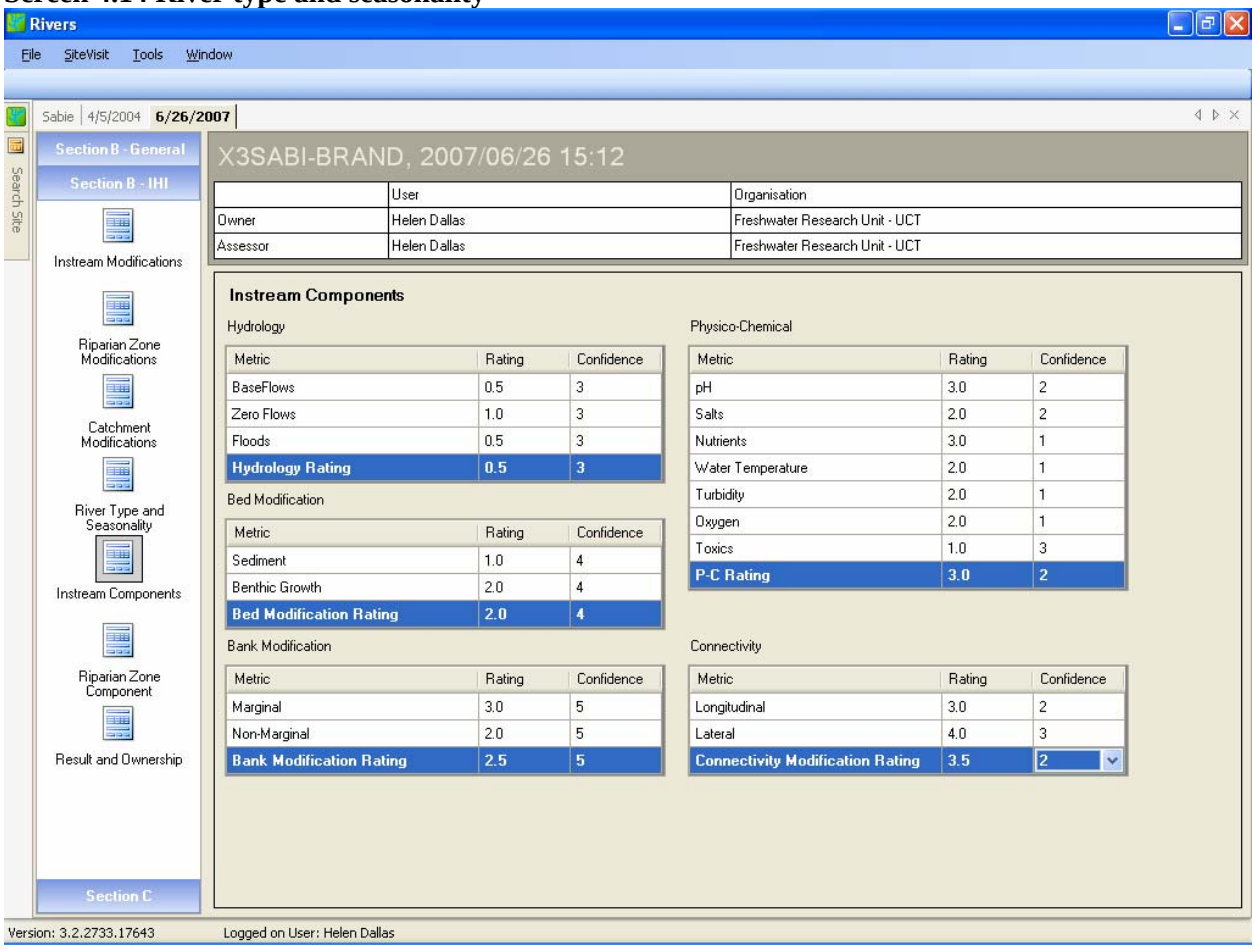
For instream, riparian zone and catchment modifications (Screen 4.13), the relevant modification or activity is selected from the drop down list by right-clicking and selecting "Add". After allocating ratings the modification is saved by right-clicking and selecting "Save". Fields in the River Type and Seasonality (Screen 4.14), IHI Instream Components (Screen 4.15), IHI Riparian Zone Components (Screen 4.16) forms are given a rating and confidence level using the drop down lists. On the Results and Ownership (Screen 4.17) form the final percentage and category for Instream and Riparian Zone Habitat Integrity are captured. Ownership (or Assessor) of the IHI data defaults to the logged in user, but may be reassigned to another user using the drop-down list if appropriate. Right-click "Delete" to delete record.



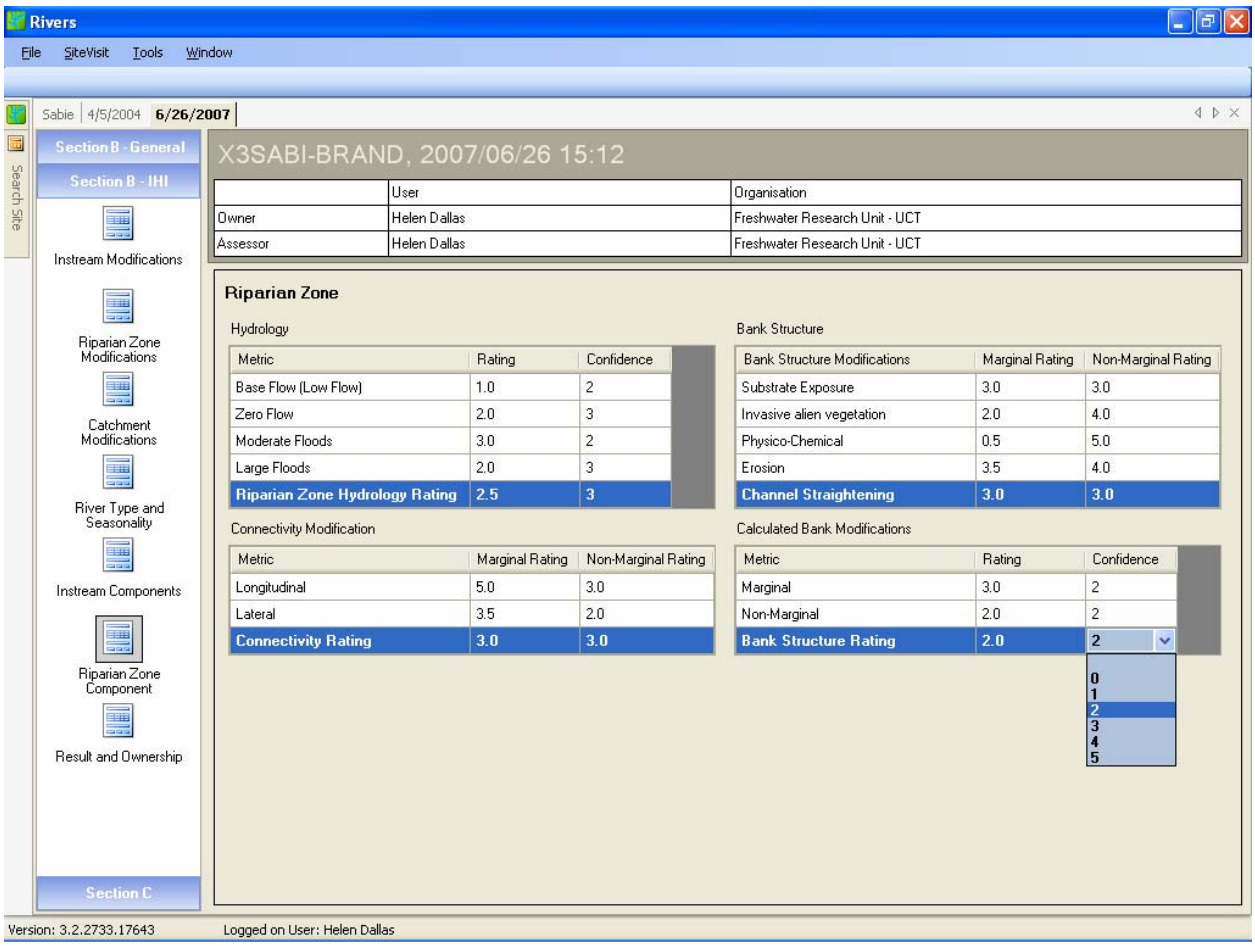
Screen 4.13 Instream, riparian zone and catchment modifications



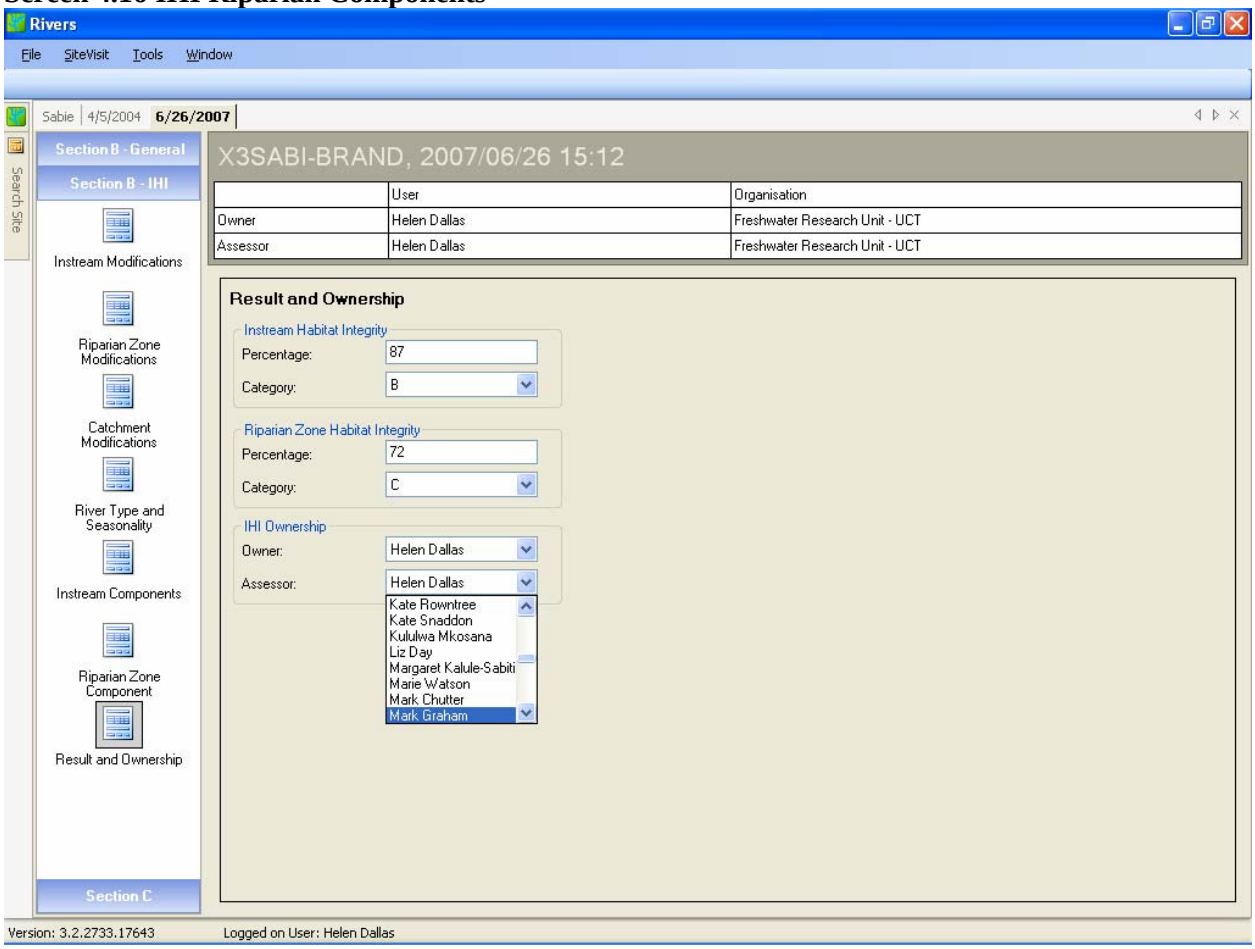
Screen 4.14 River type and seasonality



Screen 4.15 IHI instream components



Screen 4.16 IHI Riparian Components



Screen 4.17 Results and Ownership

Viewing and adding Site Visit data: Section C

Section C includes the following forms:

- General Site Visit Information
- Water Chemistry
- Stream Dimension
- Substratum Composition
- Invertebrate Biotopes
- Invertebrates
- Biotopes Sampled (IHAS)
- Fish

(a) General Site Visit Information (Screen 4.18)

This form provides information pertaining to each site visit or sampling occasion. All users may view the data but only the Record Owner may edit the data linked to the particular site visit. Each field is described briefly below and the reader is referred to the glossary or Dallas (2005) if additional clarification is required. Data is added directly in the text boxes or using the drop-down lists. Date and time formats are specified and tick boxes are used for some fields. Details of each field are given below.

Note: If data in this section is collected on different dates but is still considered to be part of the same site visit, then the earliest date should be used. For example, if SASS data was collected on 06/06/1999 and fish data on 07/06/1999 both should be entered as 06/06/1999. This is necessary to enable subsequent queries to be linked to common site visits.

- Water Level: water level at time of sampling (dry, isolated pools, low flow, moderate flow, high flow, flood)
- Velocity and discharge estimates: Optional measurement of water surface width and stream velocity for the calculation of discharge.
- Rainfall in the last 4 days? this indicates the presence and extent of any rainfall event preceding the site visit
- Canopy Cover: extent of canopy cover (open, closed, partially open)
- Impact on stream habitat: rate of the impact on channel flow of coarse woody debris or any other obstruction. Specify if the source is local or upstream and add additional comments in the text box.

(b) Water Chemistry (Screen 4.19)

General information pertaining to water chemistry such as sampling process details and information related to water condition, is recorded and displayed (Screen 24). It includes:

- Instruments in fast flow? Were the meters positioned in the fastest flowing section of the stream?
- Samples collected? Were samples collected?
- Date sent for Analysis? What was the date when the samples were they sent for analysis.
- Water filtered? Was the water sample filtered?
- Volume filtered? Mention the volume (in ml) of the water sample.
- Samples frozen? Was the water sample frozen?
- Other Preservation? If not frozen, which other method of preservation was utilised?
- Institution Samples Sent? Name the testing institution the water sample was submitted to.
- Water Turbidity? What is the turbidity of the water sample? Select from a drop down menu whether the water was clear, discoloured, opaque or silty.

All chemistry data for the site visit is given together with the standard units of measurement and values.

NB: Data should be converted to these standard units preceding data capture. Minimum and maximum values are shown as a guide for data entry and are used for "Data integrity" checking. It is possible to add a value below or above the limit, although the user will be prompted with the message "The Chemistry value is outside the expected range, do you still want to add data?" Please comment, or correct the value". To enter data, position the cursor under the "Description" column, right-click and select "Add", type the first letter of the chemistry variable you want to add and scroll down until the correct variable is highlighted, press tab twice to move the cursor to the value column and enter the value, tab to comment field and add text if necessary. Right-click and "Save" the record. Repeat process until all chemistry variables have been added. Table data may be exported to excel by right-clicking and selecting "Export to Excel".

(c) Stream Dimensions (Screen 4.20)

Macro-channel, active channel and water surface widths, left and right bank heights, and average depths of available deep- and shallow-water biotopes are selected from the drop-down list or added directly within each field or comments field. Details of the methodology are given in Dallas (2005).

(d) Substratum Composition (Screen 4.21)

The abundance of each substratum type (bedrock, boulder, cobble, pebble, gravel, sand and silt/mud) for the bed and bank is estimated using a rating scale (using the following scale: 0 – absent; 1 – rare; 2 – sparse; 3 – common; 4 - abundant; 5 – entire). The degree of embeddedness is also recorded using a drop-down list. Details of the methodology are given in Dallas (2005).

(e) Invertebrate Biotopes (Screen 4.22)

General river make-up is recorded using the drop-down list. Biotopes have been included at two levels, namely SASS biotopes (e.g. Stones In Current, Stones Out Of Current, Marginal Vegetation In Current, Marginal Vegetation Out Of Current, Aquatic Vegetation, Gravel, Sand and Silt/mud/clay) and specific biotopes (e.g. Riffle, Run, Boulder rapid, Bedrock, Chute, Cascade, Backwater, Slackwater, In Channel, Pool, Grasses, Reeds, Shrubs, Sedges, moss, trailing grasses, filamentous algae, etc.). The abundance of each biotope is rated for each SASS and specific biotope. Details of the methodology are given in Dallas (2005). To enter data, select an abundance rating for each SASS biotope using the drop-down list. Select an abundance rating for specific biotopes by highlighting the SASS biotope and selecting the rating.

(f) Invertebrates (Screen 4.23)

Both SASS4 and SASS5 data may be viewed and added, although the default version is SASS5. If SASS4 data needs to be captured the user may click this option. Users must capture SASS data at the biotope level by selecting a biotope from the drop-down list (SIC/SOOC, MV/AQV or G/S/M). These are based on the accepted biotope groupings in SASS 5 (see Dickens and Graham 2002 for more details). To capture data, position the mouse in "Taxon" column and right-click mouse, type the first letter of the taxon and scroll to the correct taxon. Tab Tab to Abundance column and enter abundance (1, A, B, C or D). Right-click and "Save" to save record, and continue until all taxa have been captured for the biotope. Select next biotope and repeat the process. To view and edit data at the Site level, click "Site Visit Level". For taxa such as Baetidae and Hydropsychidae it may be necessary to modify the site level details as per Dickens and Graham (2002). The SASS Score, Number of Taxa and ASPT are calculated automatically, as are the Air Breather Scores. Additional comments may be captured in the "Comments" field. Data may be exported to excel by right-clicking on SASS data and selecting "Export to Excel".

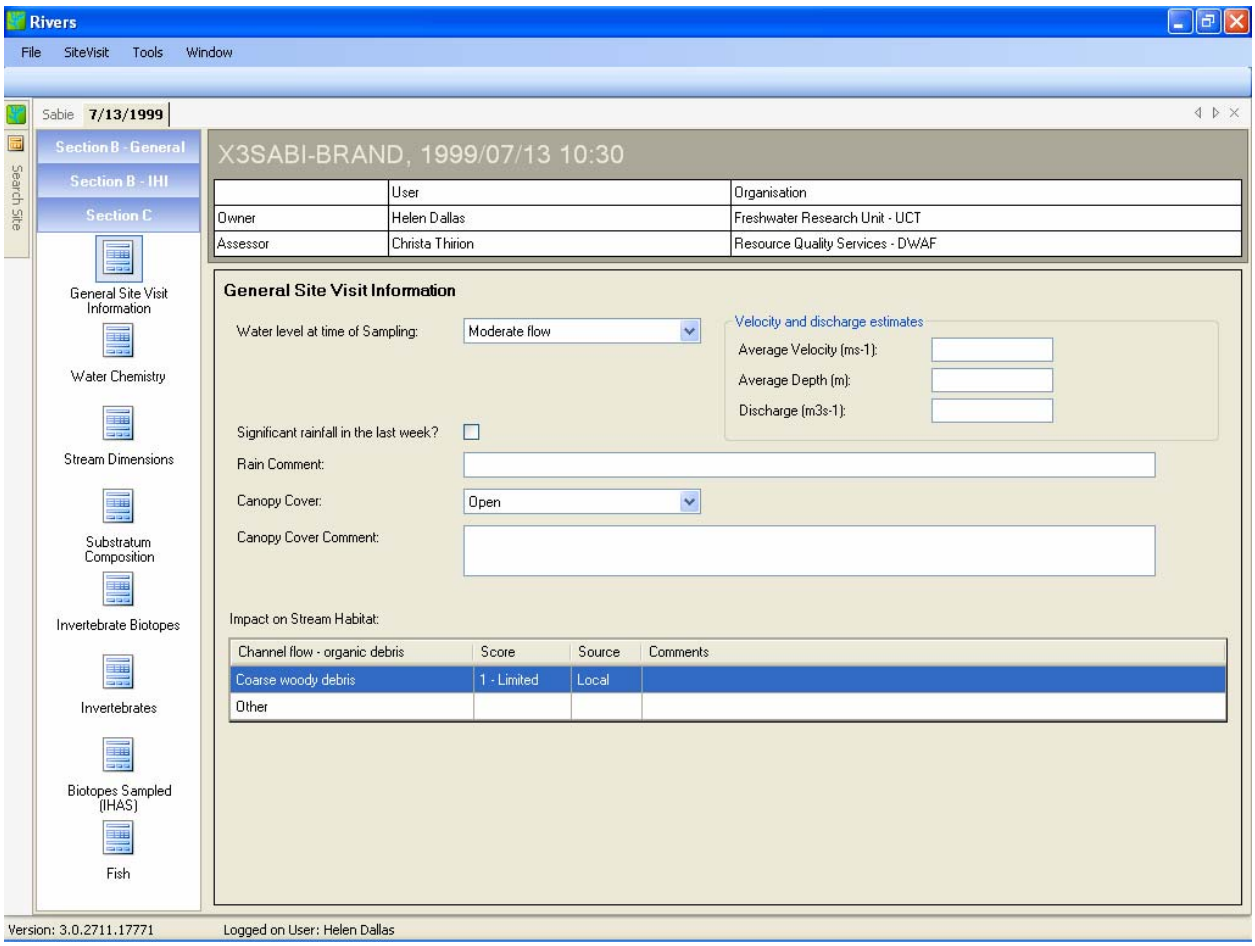
(g) Biotopes Sampled (IHAS) (Screen 4.24)

The biotopes sampled at the site are recorded on this form. It is based on the modified version of IHAS (Invertebrate Habitat Assessment System) documented in Dallas (2005). To capture data, position the mouse under the "Score" column and select a value from the drop-down list. Hint: to speed up the process enter the number, then enter and you are automatically taken to the next criterion. Continue until all criteria is scored.

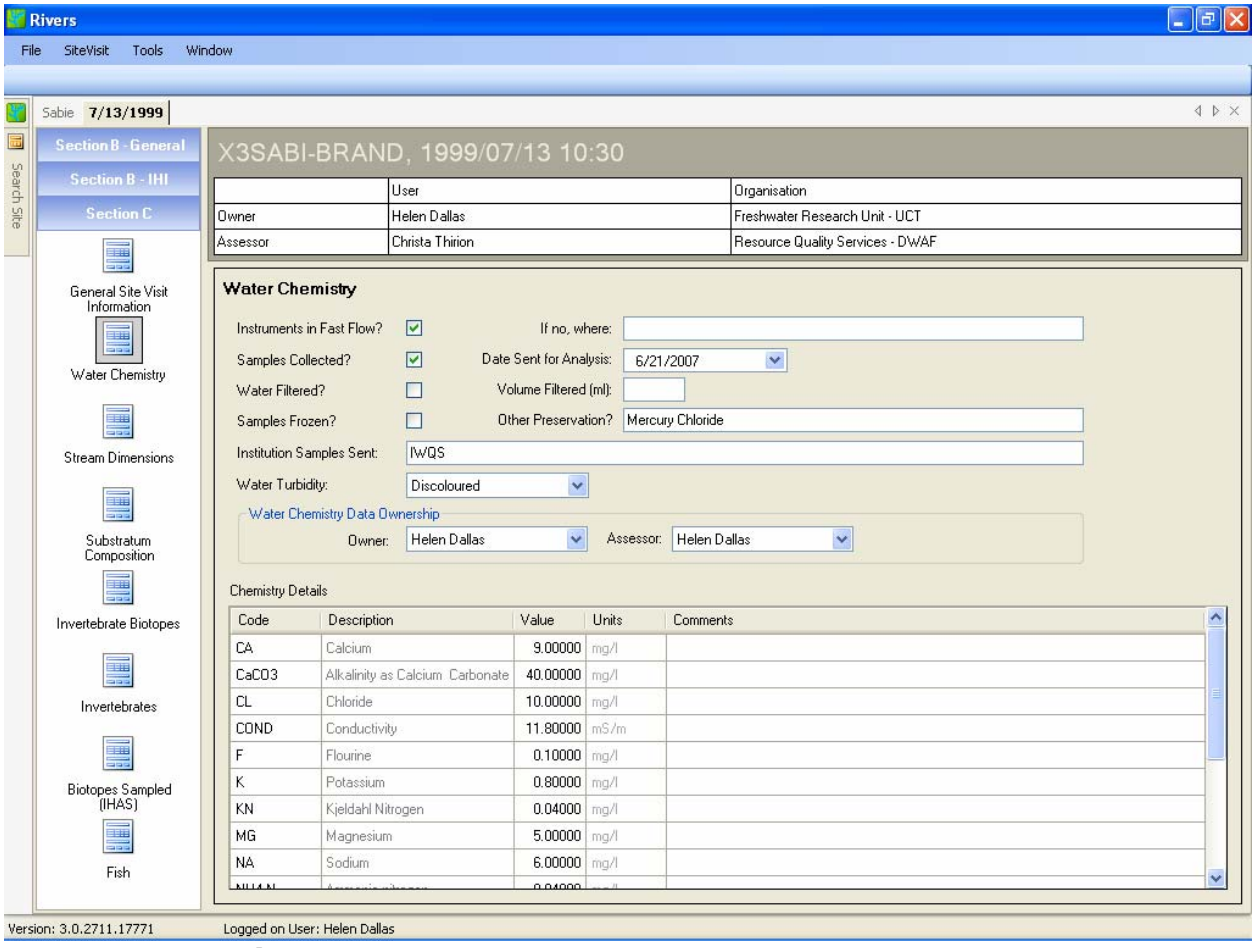
(h) Fish (Screen 4.25)

The fish component has been developed by Kleynhans (2007) and details pertaining to the method are described in Kleynhans (2007) and Dallas (2005). Data related to fish habitat, sampling effort and fish species caught are captured. Data are captured for different velocity-depth classes (fast deep, fast shallow, slow deep and slow shallow). Combinations of these are also available as well as "Unspecific habitat" where flow and depth classes where not distinguished during sampling.

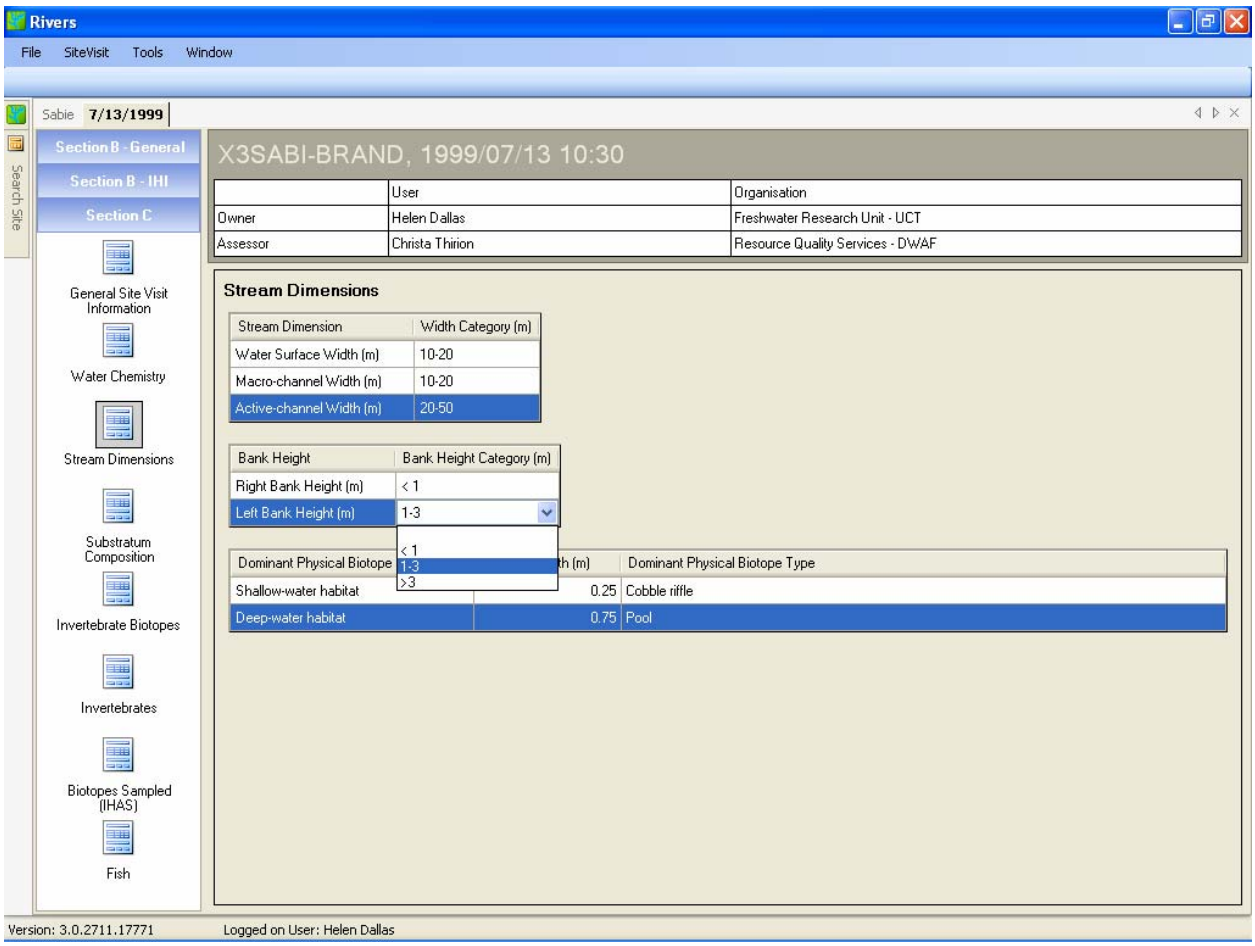
- To capture fish habitat data, select a "Fish Habitat" using the drop-down list, position the mouse in the "Abundance rating" column, and either select from the drop-down list, or type the value (between 0 and 4) hitting "Enter" after each cover type.
- To capture "Velocity Depth Classes sampled and effort", ensure that the correct "Fish Habitat" is selected, position the mouse below "Sampling method" column, right-click the mouse and select "Add". Select the sampling method using the drop-down list (e.g. cast net, electro shocker etc.). Use the Tab to move along the line to populate the other columns as described in the method (Dallas 2005). When completed, right-click and "Save" record. Repeat until all sampling methods have been captured for the "Fish Habitat", and repeat for all other "Fish Habitats" sampled.
- To capture Fish Species data, ensure that the correct "Fish Habitat" is selected and "Sampling method" is highlighted. Position the mouse below the "Code" column and right-click and select "Add". Select the fish code by typing the first letter of the fish species and using the scroll bar. Tab Tab to move to No. of Adults; Tab No. of Juveniles; Tab No. of Abnormalities. The total is calculated automatically. Right-click and select "Save" to save the record. Repeat until all fish species for the sampling method and fish habitat have been recorded. Then select the next sampling method and/or habitat and repeat until all data is captured. To export all fish data captured click the "Export" button.



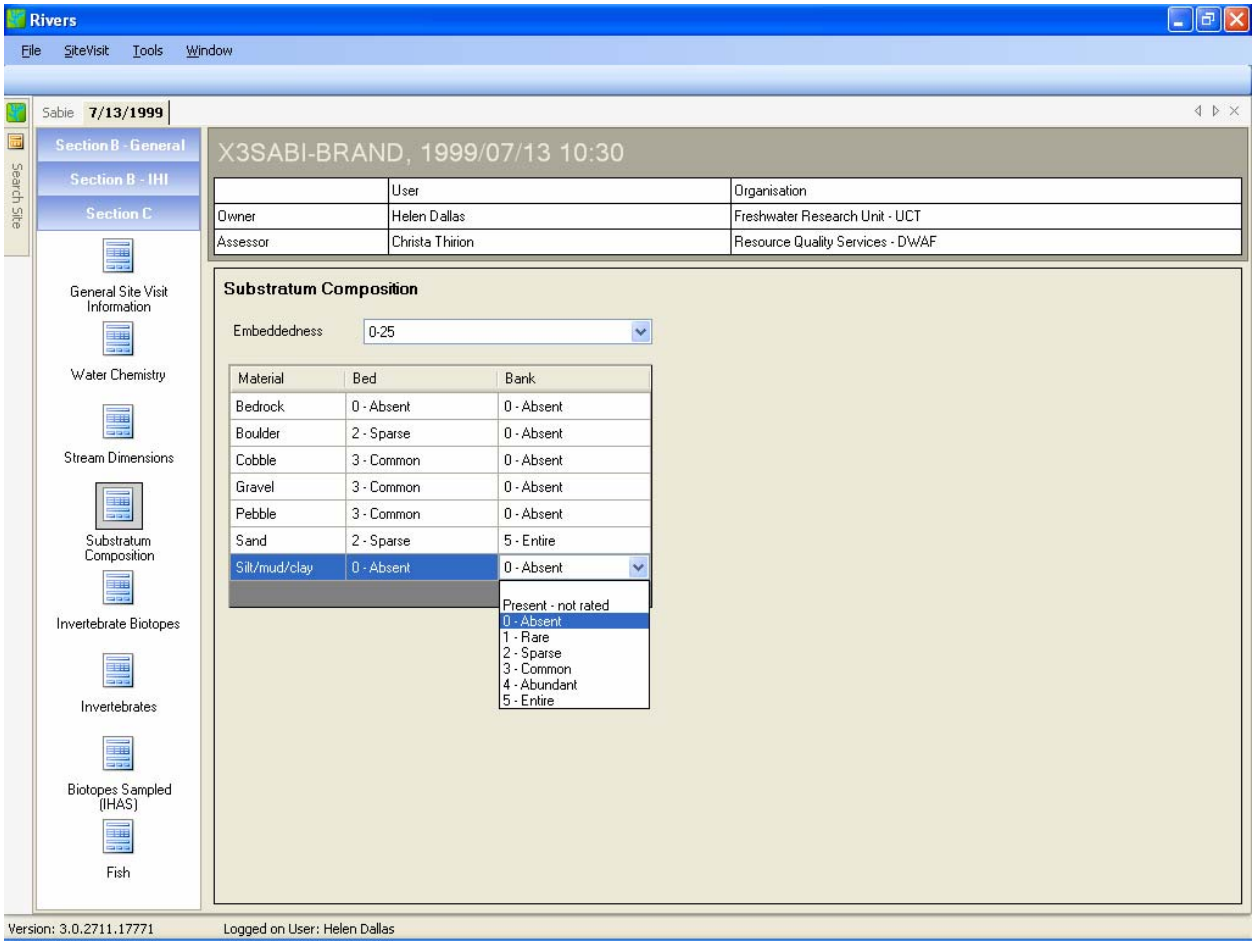
Screen 4.18 General Site Visit Information



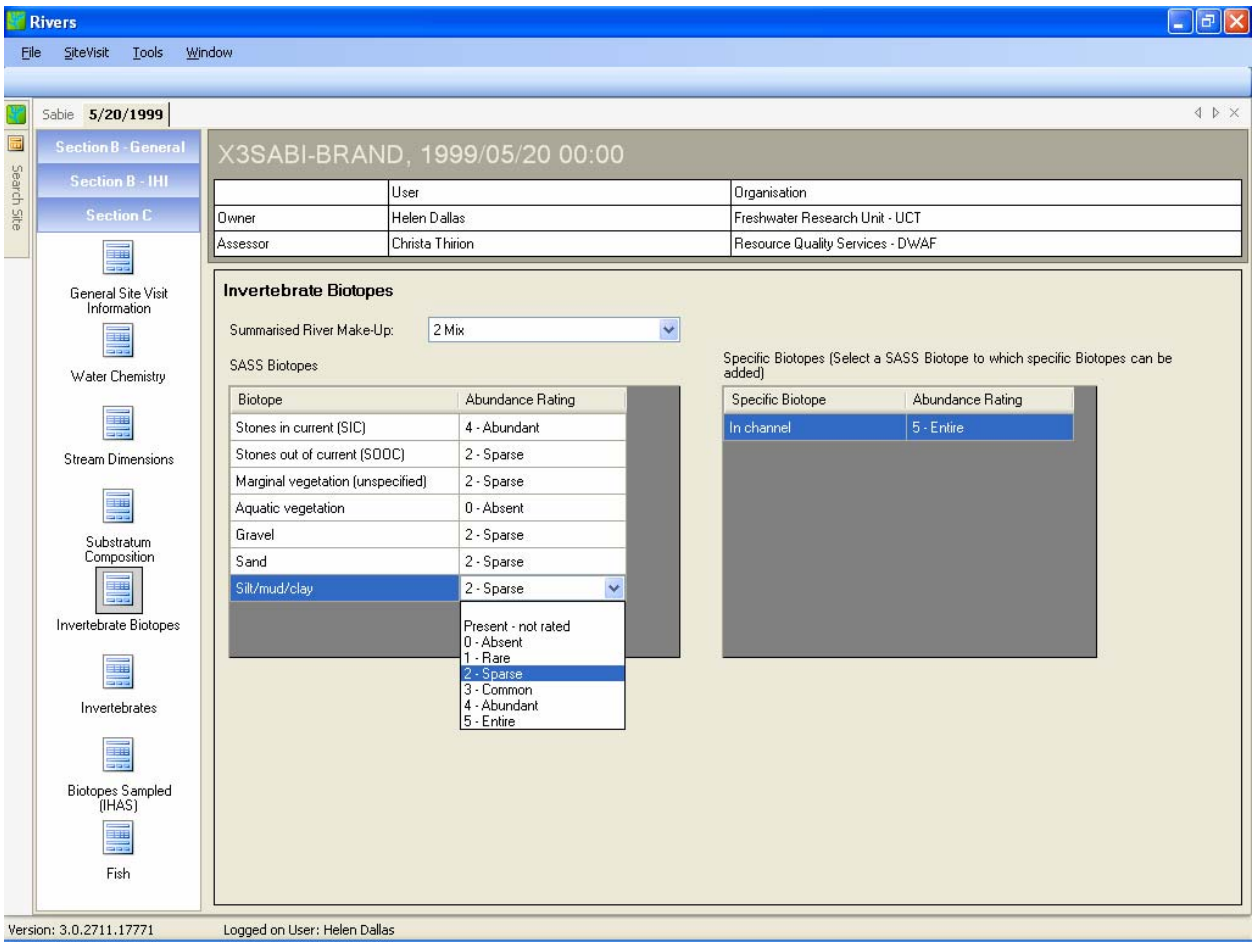
Screen 4.19 Water Chemistry



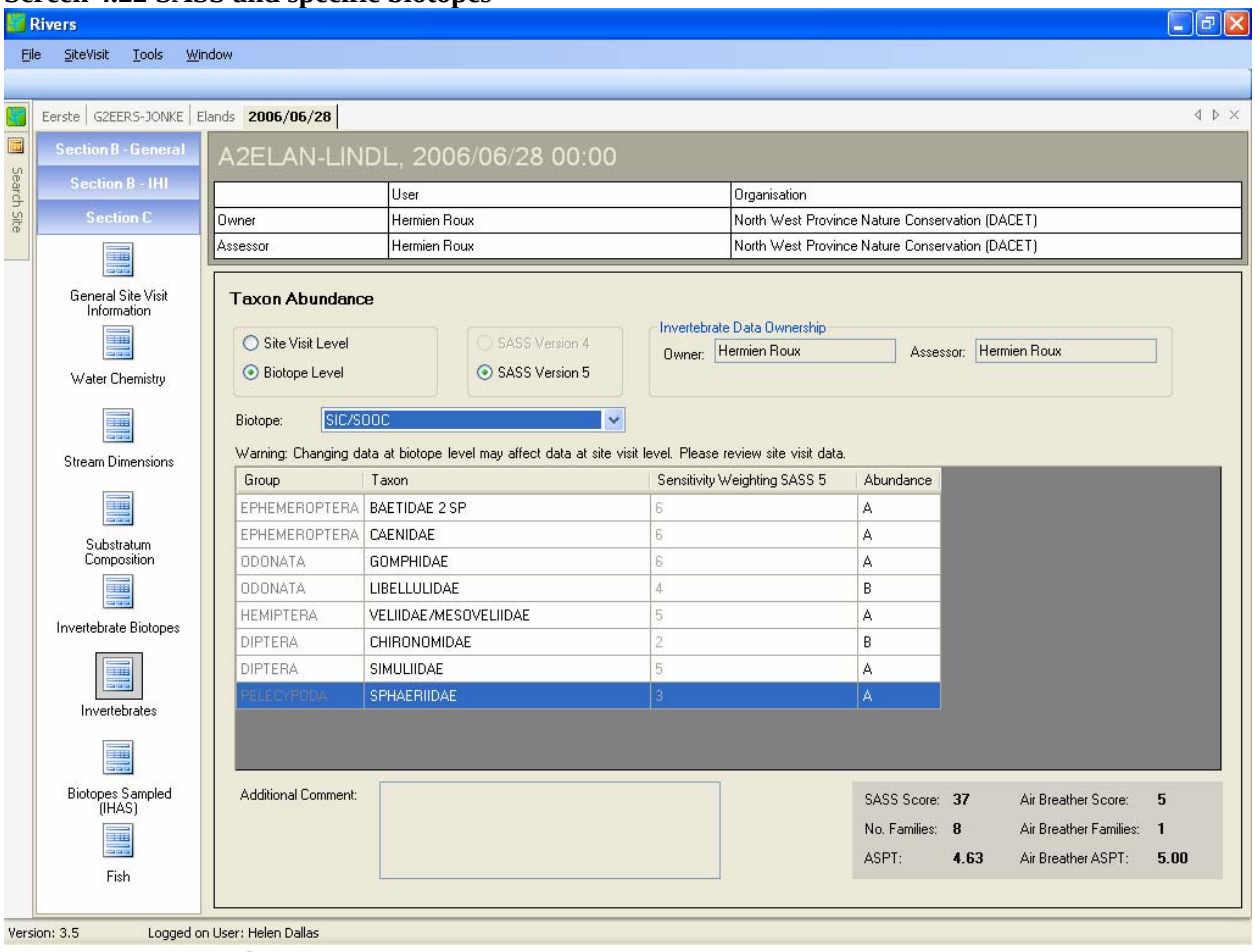
Screen 4.20 Stream Dimensions



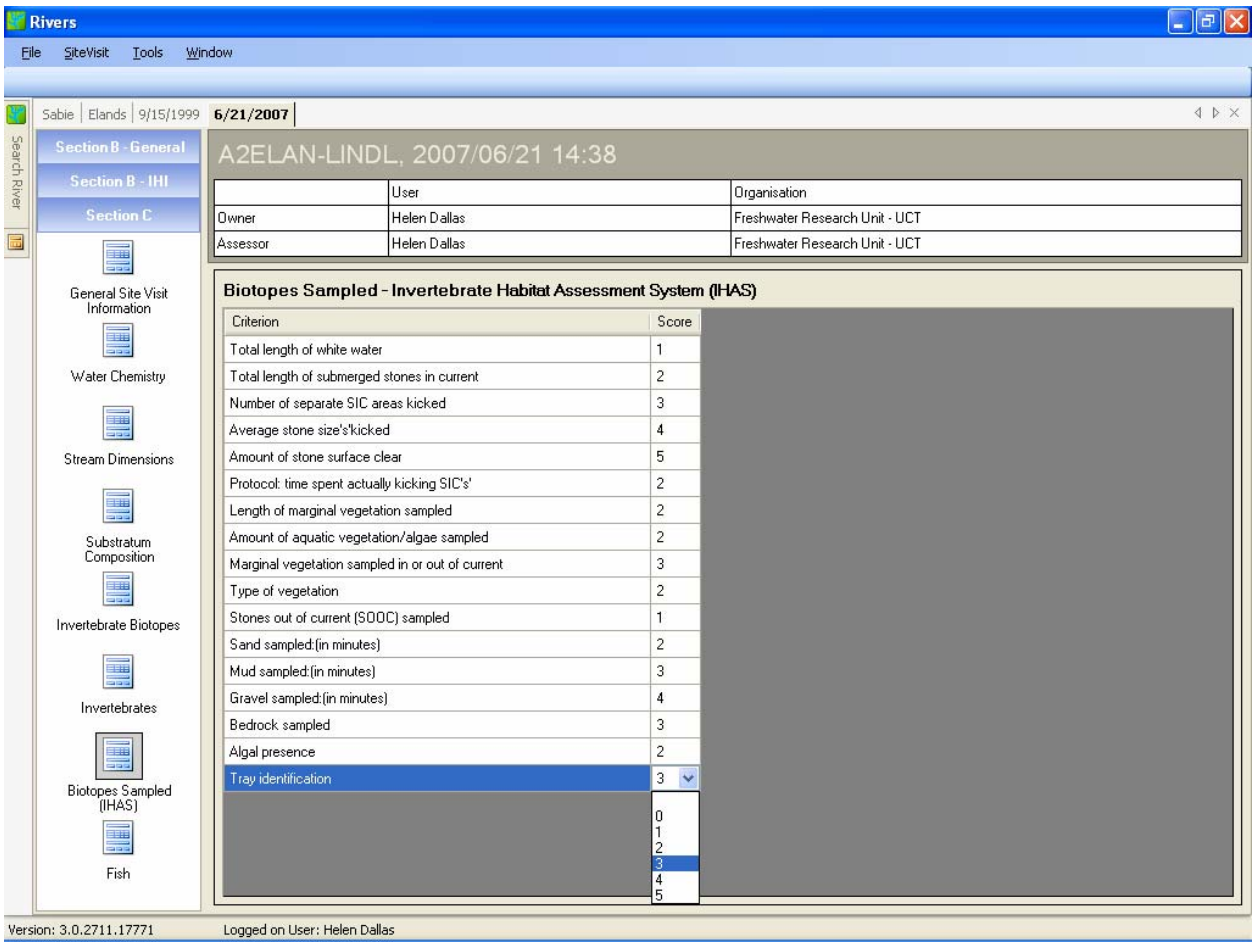
Screen 4.21 Substratum composition



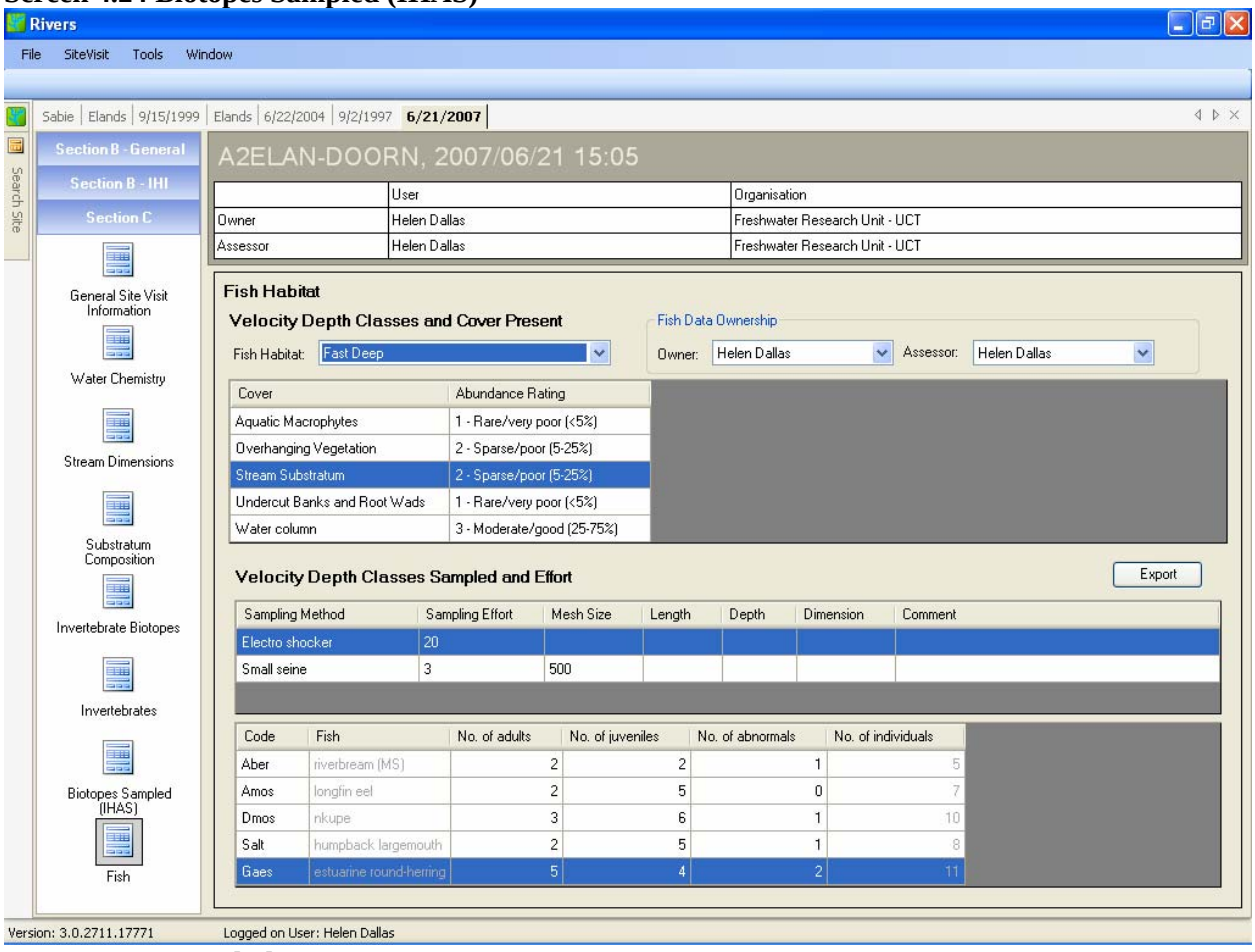
Screen 4.22 SASS and specific biotopes



Screen 4.23 Invertebrate Taxa



Screen 4.24 Biotopes Sampled (IHAS)



Screen 4.25 Fish data

5. DATA TRANSFER BETWEEN RIVERS CLIENT AND RIVERS SERVER

The data transfer functionality is available via the Rivers Client. Since data transfer is a real-time process via the internet, a broadband connection is recommended. It is essential to upload site and site visit data on a regular basis to ensure the national database remains up to date and to minimise the chance of local data loss in the event of a desktop crash. Users with slower internet connections will also benefit by uploading data regularly since less data that will mean a faster upload process. Immediately after logging onto the Rivers Client, the User will be prompted to upload data changes made since the last upload (if any). It is strongly recommended that users follow this prompt and upload outstanding data.

NB: If you experience problems uploading and downloading data, or logging on to the Rivers Server after registering online, you may get an error message similar to the following: "Proxy server HTTP 407 error". This may be due to settings on your organisation's firewall blocking your internet connection to the Rivers Server. Please contact your organisation's system administrator to enable the River url (i.e. to allow data to be uploaded and downloaded from the Rivers website), or contact the Rivers Administrator for support.

5.1. Uploading data (Screen 5.1)

- In the Rivers Client, open the "Tools: Data Transfer Utility" menu and click 'Upload.
- Click "Site and Site Visit Data"
- Select the Drainage Region in which your site(s) falls. If you need to check it is on the first form of the Section A. Hint: If you are not sure what data is new and needs to be uploaded, scroll through the drainage regions. The system determines which sites and site visits have changed or been added to the system. Data in each drainage region needs to be uploaded separately.
- The system validates the site and site visit data to determine suitability for uploading. The user can only upload data for which the current user is the owner.
- The system displays a list of rivers and its related sites and site visits. The user selects the river to be uploaded by clicking in the river(s) box.
- The user initiates the upload process for selected data.
- All new or modified entries in the Assessor table are automatically uploaded to the server before site and site visit data are processed. The system sends data one site at a time, followed by the site visits for that site.
- The server receives and validates the data. New sites are created and existing sites are updated.
- During the site upload, if any site data fails during the upload to the server, that site and the error is returned to be logged and displayed to the client. Other sites continue to be uploaded. During the site visit upload, if any site visit data fails during the upload to the server, that site visit and the error is returned to be logged and displayed to the client. Other site visits continue to be uploaded. If any data has been modified on the server, the upload for the site fails and the user must download the site before re-uploading the data.
- The systems displays a report to the user indicating which sites and site visits were uploaded successfully and which site and site visits returned errors. Errors should be resolved before attempting to re-upload the data.

5.2. Downloading data (Screen 5.2)

This section describes the operations required to download river, site, site visit and assessor data. Static data that has changed on the server since the last download event is also downloaded. Assessor data is downloaded at each new upload session.

- In the Rivers Client, open the "Tools: Data Transfer Utility" menu and click 'Download.
- Click "Refresh Pick Lists" to download the most recent modifications to the administrative component, e.g. change in SASS taxon sensitivity weightings, chemical variable additions, new land-uses, etc.
- Click "Refresh Rivers" to download the latest national rivers coverage. All changes made to any river on the server since the last river download are retrieved and updated on the client database.
- Click "Download site and site visit data for selected rivers" to download data for specific river(s). It is important to limit the number of rivers selected, especially when using slow connections such as dial up. As a guide, on broadband and network systems, the Berg River (and its tributaries), or the Sabie River (and its tributaries) can be downloaded in one go. The Limpopo River (and its tributaries) however cannot, and the user must select a subset of rivers for download. Expand the list by clicking on the + and click the required rivers. To select only the main river and not its tributaries, use Shift/Click.
- The system displays a report to the user indicating which data was downloaded successfully.

5.3. Assessor maintenance - adding Assessors via Rivers Client (Screen 5.3)

All registered Users can edit Assessor data or add an Assessor (i.e. the person who actually did the sampling) via the Menu Bar by selecting File, Assessor. Then with the mouse positioned under the surname column, right-click and select "Add". Complete the details of the Assessor and right0click and Save" to save the record.

5.4. SASS proficiency status (Screen 5.3)

This is an administrative function undertaken by the Rivers Administrator in the Rivers Client. Normal users do not have rights to modify this. Each User is given a validation rating according to their SASS proficiency testing for a specific time period. Users are able to view the SASS proficiency validation for themselves and other users via the Rivers Client.

- Click on File: Assessors.
- Click on the assessor to be viewed.

5.5. SASS data import (Screen 5.4)

There are two steps to importing SASS data into the Rivers Client. The first is to capture the data in Excel using the SASS Import Template; the second is the import the file into the Rivers Client. Follow the steps below to import SASS data.

- Download the SASS Import Template from the Rivers Server: Documentation
- Save and open in Excel
- Enter data into the template, including Owner, Assessor, Site Code, Sampling Date and abundance. Copy fields as appropriate for each biotope and site visit. NB: The Site Code needs to exist before

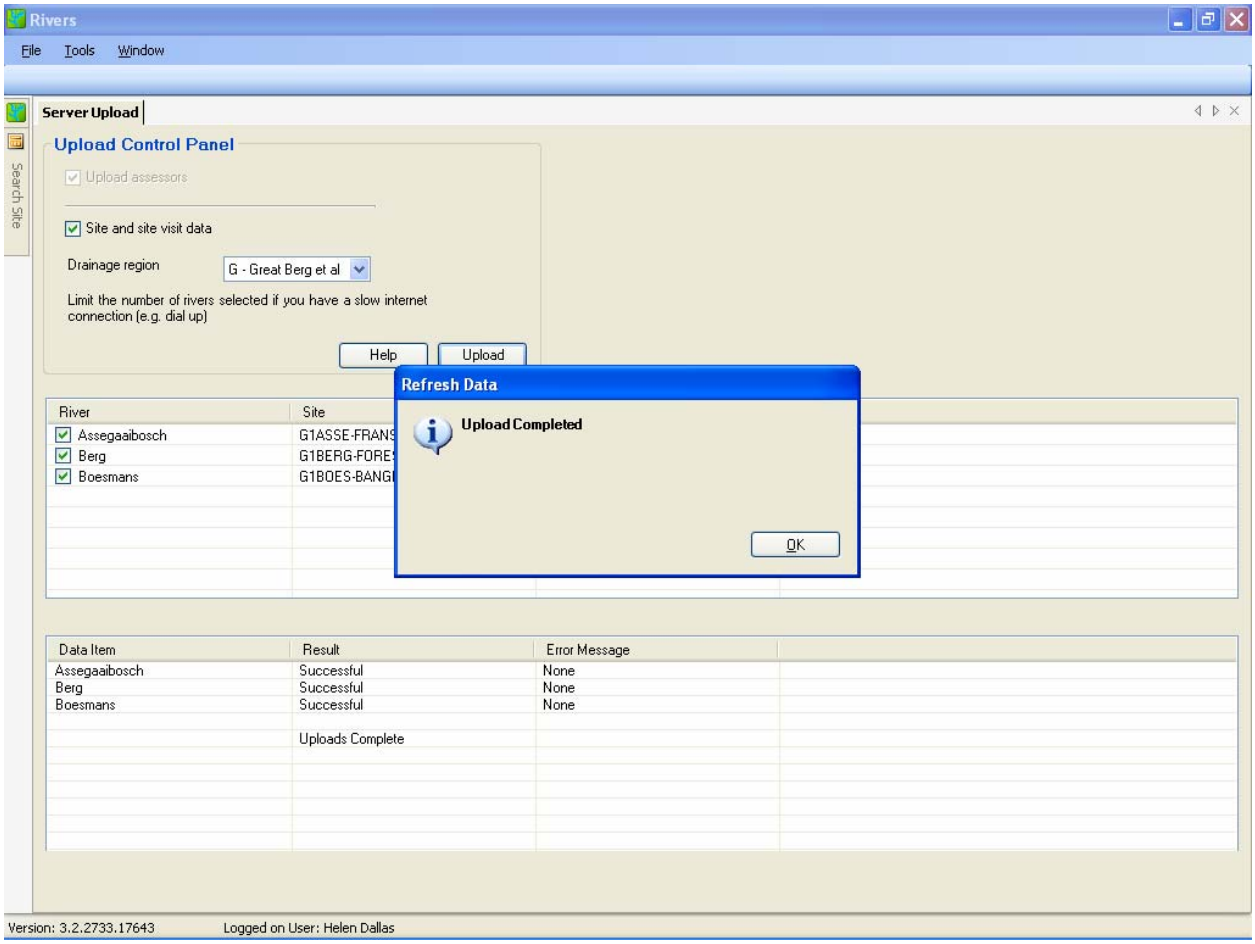
SASS data can be imported. Check on your Rivers Client for the correct Site Code. Use the "Reference" spreadsheet to check details.

- Once all data has been captured, it is necessary to delete the blank lines, i.e. where no abundance in given. To do this add a temporary column called "Order" and number it sequentially, 1, 2, 3, etc. (Hint: Type 1, 2, 3 then highlight numbers and drag right-hand corner of block to end of column to auto-number entire column). Select the entire block of data and using the menu, Select "Data: Sort", sort on abundance. Then delete all the records that have no abundance. Reselect block of data and sort on Order. Check your data to ensure that it is correct. Then delete the "Order" column.
- Check the data format (e.g. 12-Jan-2007): Highlight the Sampling Date Column and select Format: Cells, select Custom from Category and scroll to "dd-mmm-yy" under Type. Add an extra yy so that it reads: dd-mmm-yyyy.
- Save your file in an appropriate directory as a .csv file using the File: Save As and selecting Save as Type CSV (Comma delimited). Hint: to check that date format is correct, open the file using "Notepad" which returns it as a text file.

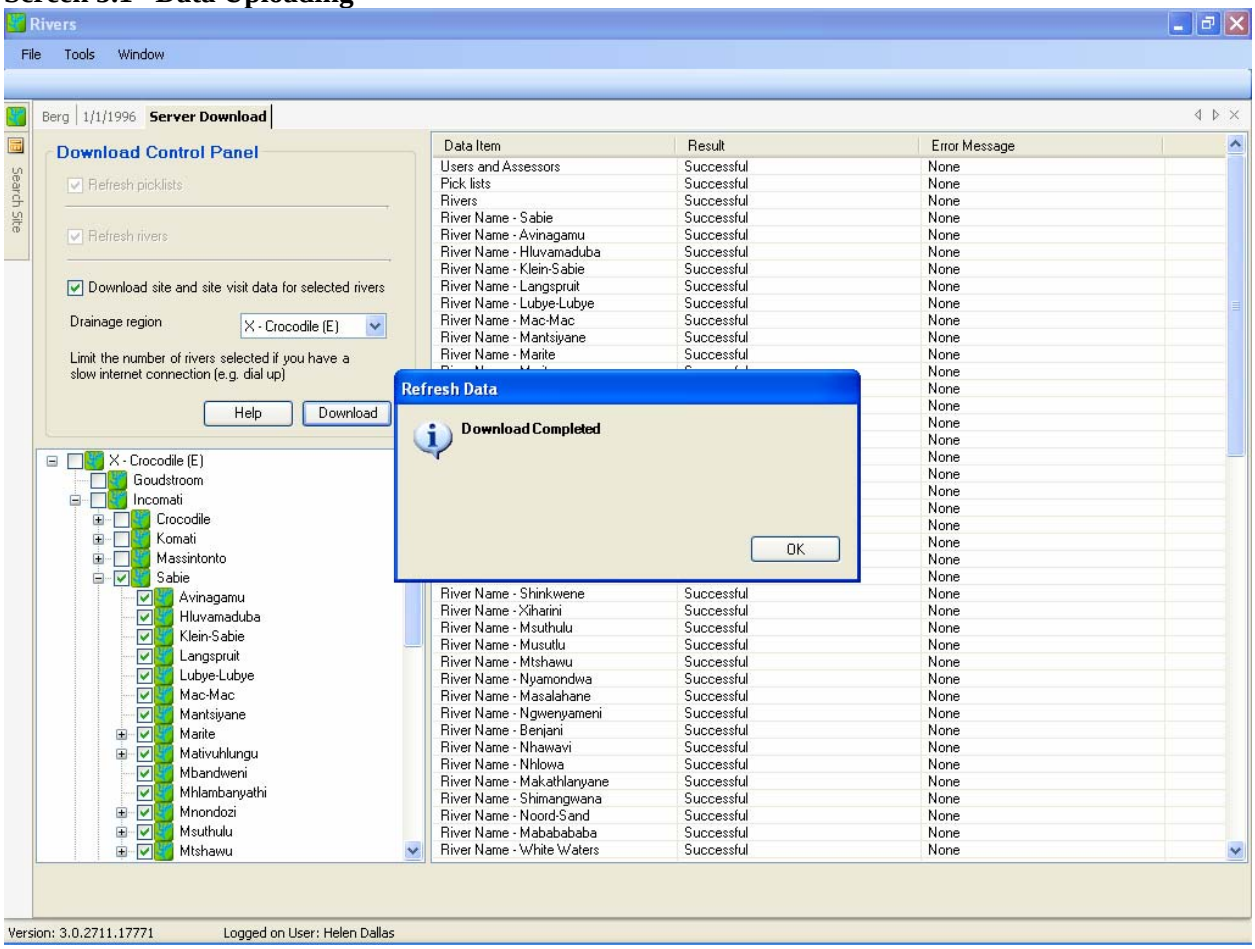
NB: Limit the number of rows to 1000, to speed up the import process

- Click on Tools : SASS Import
- Browse to the SASS file required to be imported into the database.
- Once the file has been located, click on Import. Note this needs to be .csv file, which can be created and saved in Microsoft Excel.
- The results of the import will be shown on the screen.
- If errors are reported, check using the "Reference" button. This opens an excel spreadsheet with Owner, Assessor, SASS Biotope, Taxon Name and Abundance information. The user needs to check that the reference information matches the data in their import file as it is critical that all the fields match exactly or the import will fail. The Column headers on the import form should also match those in the user spreadsheet exactly.
- Note: the owner of the site visit is derived from the logged in user.
- Please be patient when importing a large amount of data as the import takes some time.

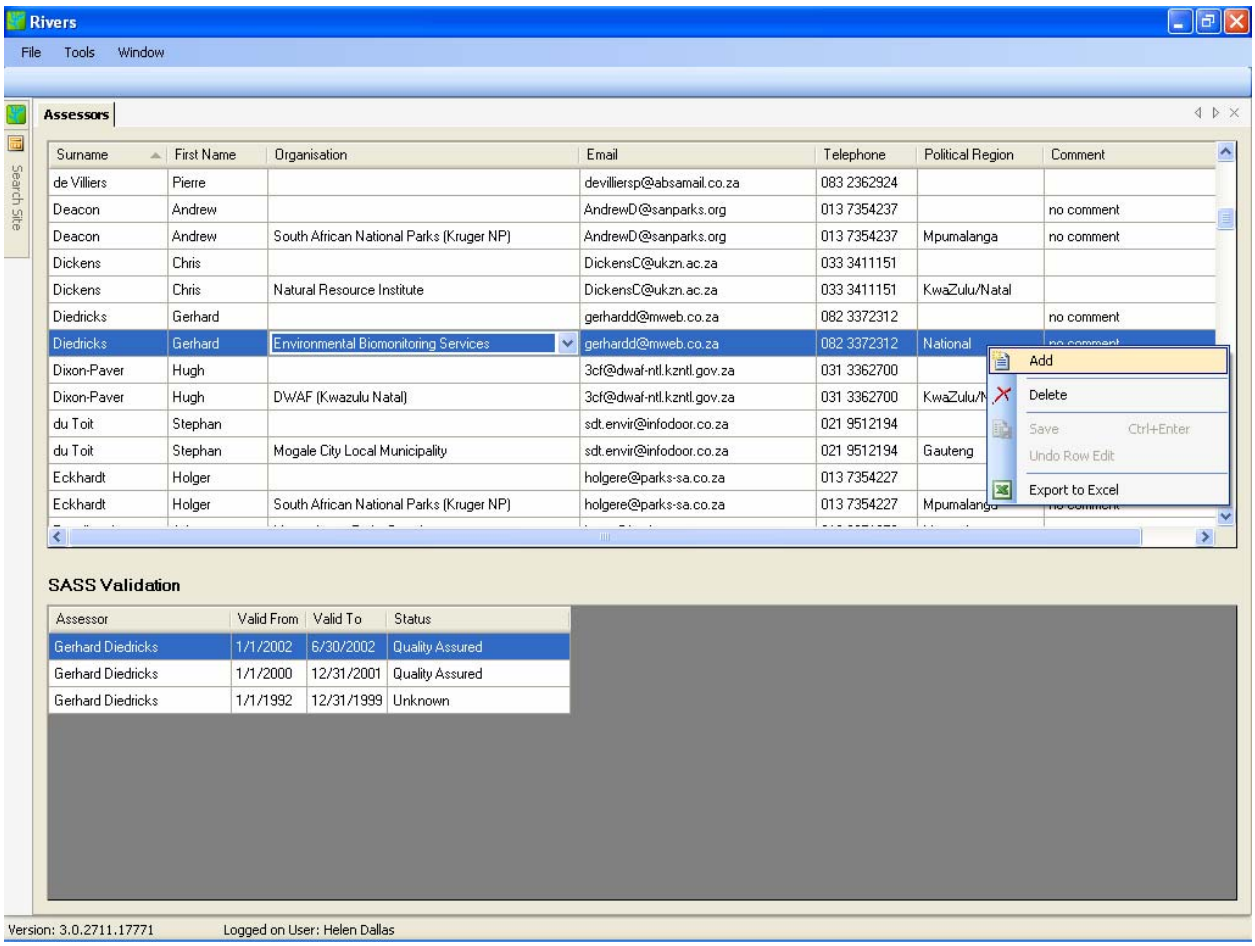
NB: It is critical to specify the date format in Excel as Day-Month-Year, i.e. 01-Jan-2007. This ensures that the imported date is correct in the Rivers application. To change the date format, highlight the column, select Format/Cells, scroll to Custom from the category and type: dd-mmm-yyyy in the "Type" field.



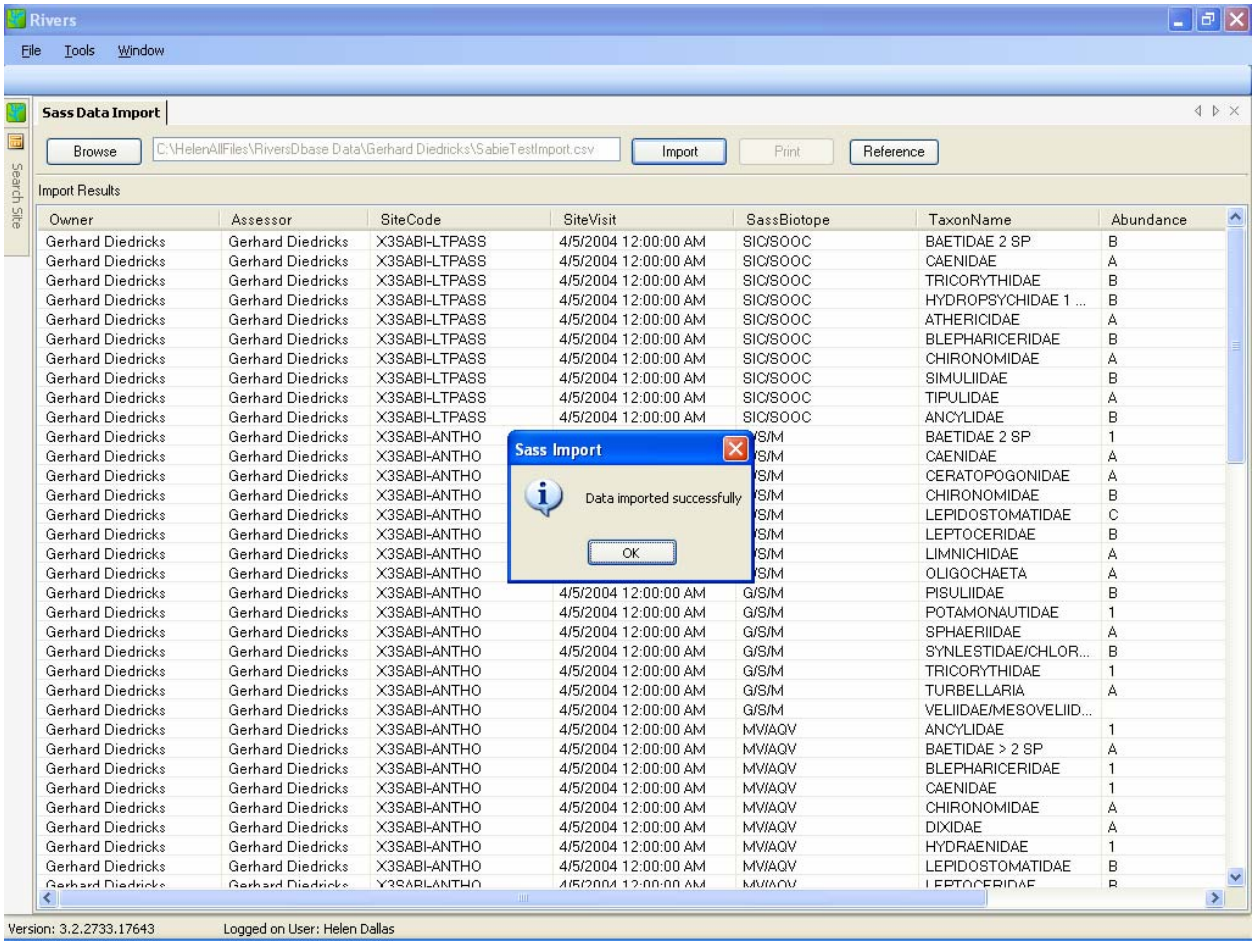
Screen 5.1 Data Uploading



Screen 5.2 Data Downloading


Rivers
File Tools Window
Assessors
Search Site
Surname First Name Organisation Email Telephone Political Region Comment
de Villiers Pierre devilliersp@absamail.co.za 083 2362924
Deacon Andrew AndrewD@sanparks.org 013 7354237 no comment
Deacon Andrew South African National Parks (Kruger NP) AndrewD@sanparks.org 013 7354237 Mpumalanga no comment
Dickens Chris DickensC@ukzn.ac.za 033 3411151
Dickens Chris Natural Resource Institute DickensC@ukzn.ac.za 033 3411151 KwaZulu/Natal
Diedricks Gerhard gerhardd@mweb.co.za 082 3372312 no comment
Diedricks Gerhard Environmental Biomonitoring Services gerhardd@mweb.co.za 082 3372312 National
Dixon-Paver Hugh 3cf@dwaf-ntl.kzntl.gov.za 031 3362700
Dixon-Paver Hugh DWAF (Kwazulu Natal) 3cf@dwaf-ntl.kzntl.gov.za 031 3362700 KwaZulu/N
du Toit Stephan sdt.envir@infodoor.co.za 021 9512194
du Toit Stephan Mogale City Local Municipality sdt.envir@infodoor.co.za 021 9512194 Gauteng
Eckhardt Holger holgere@parks-sa.co.za 013 7354227
Eckhardt Holger South African National Parks (Kruger NP) holgere@parks-sa.co.za 013 7354227 Mpumalanga
Add
Delete
Save Ctrl+Enter
Undo Row Edit
Export to Excel
SASS Validation
Assessor Valid From Valid To Status
Gerhard Diedricks 1/1/2002 6/30/2002 Quality Assured
Gerhard Diedricks 1/1/2000 12/31/2001 Quality Assured
Gerhard Diedricks 1/1/1992 12/31/1999 Unknown
Version: 3.0.2711.17771
Logged on User: Helen Dallas

Screen 5.3 Assessor data and SASS Validation Status


Rivers
File Tools Window
Sass Data Import
Search Site
Browse
C:\HelenAllFiles\RiversDbase Data\Gerhard Diedricks\SabieTestImport.csv
Import
Print
Reference
Import Results
Owner Assessor SiteCode SiteVisit SassBiotope TaxonName Abundance
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC BAETIDAE 2 SP B
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC CAENIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC TRICORYTHIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC HYDROPSYCHIDAE 1 ... B
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC ATHERICIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC BLEPHARICERIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC CHIRONOMIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC SIMULIIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC TIPULIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-LTPASS 4/5/2004 12:00:00 AM SIC/SOOC ANCYLIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M BAETIDAE 2 SP 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M CAENIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M CERATOPOGONIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M CHIRONOMIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M LEPIDOSTOMATIDAE C
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M LEPTOCERIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M LIMNICHIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO /S/M OLIGOCHAETA A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M PISULIIDAE B
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M POTAMONAUTIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M SPHAERIIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M SYNLESTIDAE/CHLOR... B
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M TRICORYTHIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M TURBELLARIA A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM G/S/M VELIIDAE/MESOVELIID...
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV ANCYLIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV BAETIDAE > 2 SP A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV BLEPHARICERIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV CAENIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV CHIRONOMIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV DIXIDAE A
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV HYDRAENIDAE 1
Gerhard Diedricks Gerhard Diedricks X3SABI-ANTHO 4/5/2004 12:00:00 AM MV/AQV LEPIDOSTOMATIDAE B
Sass Import
Data imported successfully
OK
Version: 3.2.2733.17643
Logged on User: Helen Dallas

Screen 5.4 SASS Data Importing

5.6. Updates (Service Packs)

Service Packs are software patches that are released at *ad hoc* intervals, and downloaded automatically by the Rivers Client. These software patches permit users to update Rivers Client with the most recent structural, functional and data changes without having to re-install the entire Rivers Client. If an internet connection is available when a client logs on, the Rivers Client checks for new service packs and prompts the user to download the latest updates (if available). The service pack is then automatically downloaded and applied by the Rivers Client. The user can also use the Menu Toolbar to check for Updates and download them (Tools, Check for Updates).

6. QUERYING THE DATABASE (QUERY MASTER)

The Query Master is an HTML application, which allows the user to construct user-defined queries by combining the available attributes (fields) of registered data components (pre-defined queries). These can be sorted and filtered to control the data that is returned by the query. The Query Master can be used to query the user's local copy of the Rivers Database or the "national" Rivers Database, which would constitute the most up to date version of all data, collected nationally and transferred to the national administrator. The Query Master can therefore be accessed via the internet independently of the Rivers Database. The Query Master is designed to filter the dataset using set criteria so that the raw data required can be copied to a spreadsheet (such as MS Excel) for further analyses.

6.1. Basic structure of the Query Master

The Query Master consists of five main screens, each with a header that provides a description of the steps that should be followed to select data components[1] and filter data. These forms are:

Primary Data Component Selection (Screen 6.1)

Allows the selection of one of the primary data components that group primary data relevant to specific query requirements. The "Description" field indicates the type of information that can be accessed by a specific component and the "Data Category" field indicates the source of the information within the Rivers Database. Only one Primary Data Component is selected for a specific query.

Secondary Data Component (Combine Components) (Screen 6.2)

Allows the selection of additional Secondary Data Components to combine with the Primary Data Component previously selected on the "Primary Component Screen".

Field Selection (Screen 6.3)

Contains a list of the available fields that can be used in a query for filtering and displaying.

Define Filter Criteria (Screen 6.4 and 6.5)

Allows the user to define criteria for filtering the data. It includes a screen, which permits the selection of values or items that are already in the database.

[1] Data Components are units of data assembled by pre-defined queries. They can contain data from one or many tables within a database. A Data Component is a chunk of raw data that can be filtered, drilled in and queried on until the required results are obtained.

Display report (Screen 6.6)

This displays the results of the query.

These screens can be accessed via the Menu bar on the left of each screen under "Go to" with the same names. The full Menu bar "pops out" when the cursor is moved over the bar. Additional guidance and descriptions of the process may be viewed by clicking on the icon next to the various headings.

6.2. Step-by-step instructions on using the Query Master

The Query Master may be accessed within Rivers Client by:

- using the "Rivers Toolbar" by selecting "Rivers Functions/Query Database", or
- via Windows by selecting "Start: Programs: Rivers Database 2007: Query Master" or via the Shortcut created on the desktop.

Creating a new query:

In the "Primary Data Component Selection" screen (Screen 6.1):

- Select one of the five pre-defined Primary Data Components that contain the primary fields that are relevant to a specific query. For example, to return data relevant to a site only, with no requirements for site visit data, select "Information – Site".
- Use the description field to guide the selection of the most appropriate Primary Data Component.
- Click on "Next" to proceed to the "Secondary Data Components (Combine Components) screen.

In the "Secondary Data Components (Combine Components)" screen (Screen 6.2):

- Select one or more Secondary Data Components. **Note**: Because of the nature of the relationships between data in different tables, only one of the "one-to-many" relationship components can be selected at a time.
- Use the description field to guide the selection of the most appropriate Secondary Data Component.
- Should all the required fields be contained within the Primary Data Components, then select the "proceed without combine" button to continue without combining any Secondary Data Components.
- If Secondary Data Components have been combined, then click "next" to continue to the "Field Selection" screen or "back" to return to the previous screen.

In the "Field Selection" screen (Screen 6.3):

- Select the fields that are desired for filtering or querying. These are listed according to the respective data components previously selected. "Select all" and "Clear all" are used to select or clear all the displayed fields respectively. Alternatively, the individual fields can be selected by ticking the appropriate boxes.
- If no filtering of data is required, then click "Display report" to return the query results.

In the "Define Filter Criteria" screen (Screen 6.4 and 6.5):

- Add the required filter/s by following the steps below:
- Select a field from the "Field Name" drop-down menu.
- Select the appropriate operator (see section 6.3) for filtering the field from the "Operator" drop-down menu.

- Enter the value/s or items for filtering from the “Values” column according to the operator that has been selected. This can be achieved by simply typing in letters or numbers or by clicking on the “….” box that appears under “Value”. This opens a list of all items/values already entered into the database. Select the required values or items that appear in the “available fields” box on the left of the screen. Click the right arrow button or double click on these values or items to move them to the “selected fields” box on the right hand side of the screen. Click “done” to return to the “Define Filter Criteria”.
- Click the "Add Filter" button. To add additional filters, repeat the steps outlined above.
- To delete a filter click the corresponding "Delete" button.
- Click “next” to continue to the “Display Report” screen or “back” to return to the previous screen.

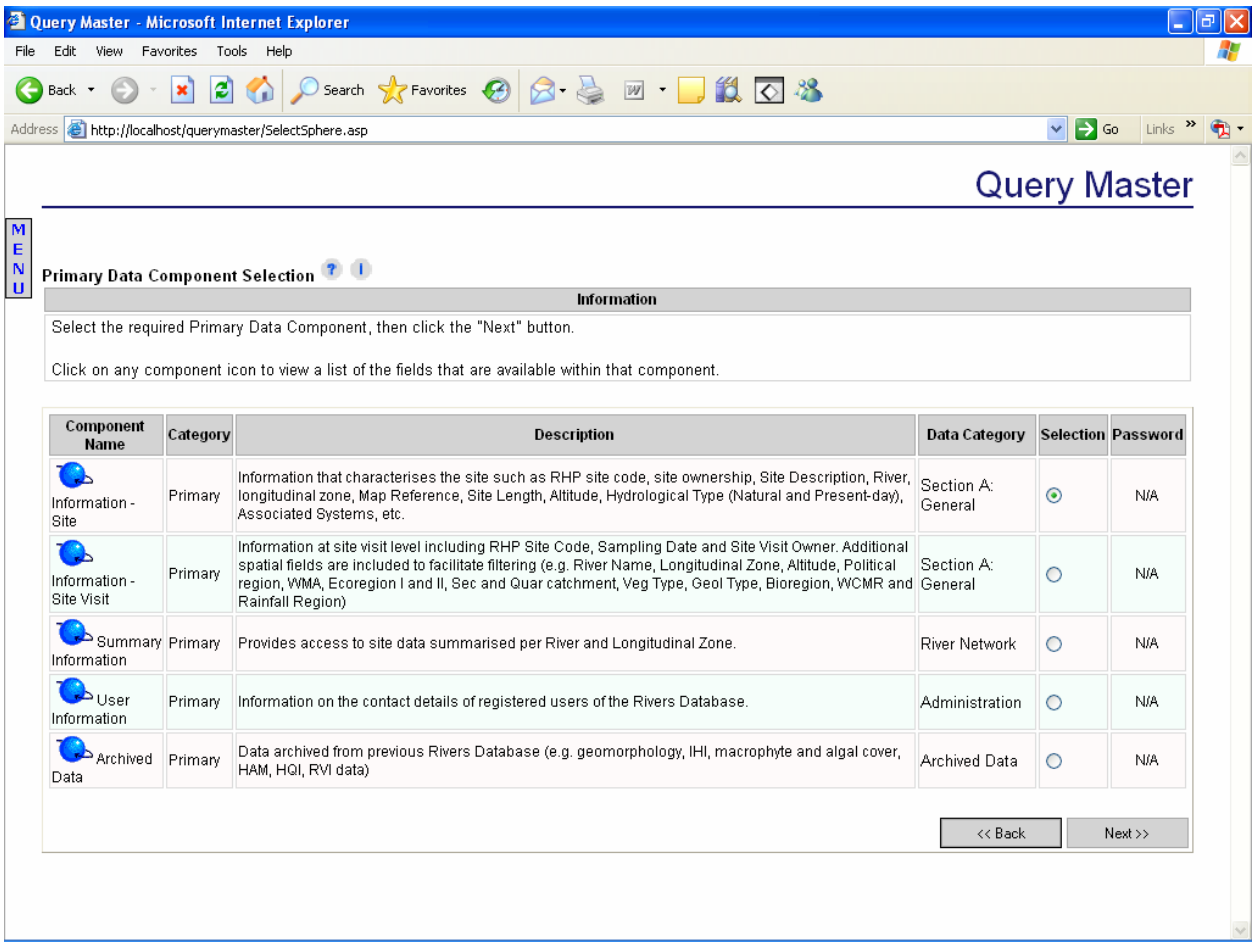
Note: If filtering is done using “River” only those rivers that have sites on them will be returned. If a river is not visible in the filter form, it means that no data exists for that site.

In the “Query Output” Screen (Screen 6.6):

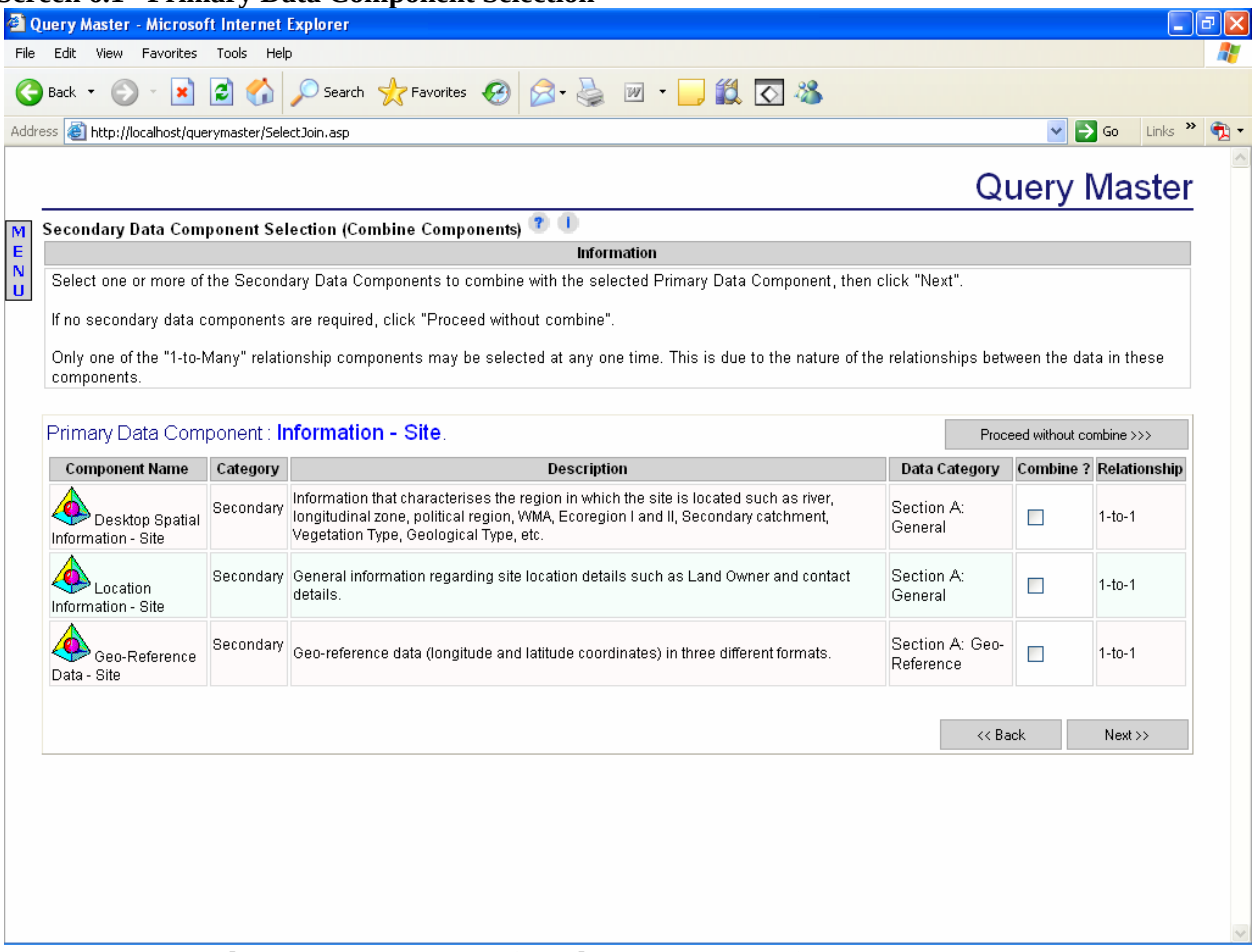
The final screen displays the query result as specified in the filtering criteria previously selected. The query can be:

- saved by clicking the “save query” button available under “file” in the menu to the left of the screen and then accessed via the “open query” button at a later stage, or
- exported to Excel as a CSV file, click “Export to Excel (csv) under “File” in the menu to the left of the screen. (**Hint**: it is better to select “Save As” rather than “Open”.)

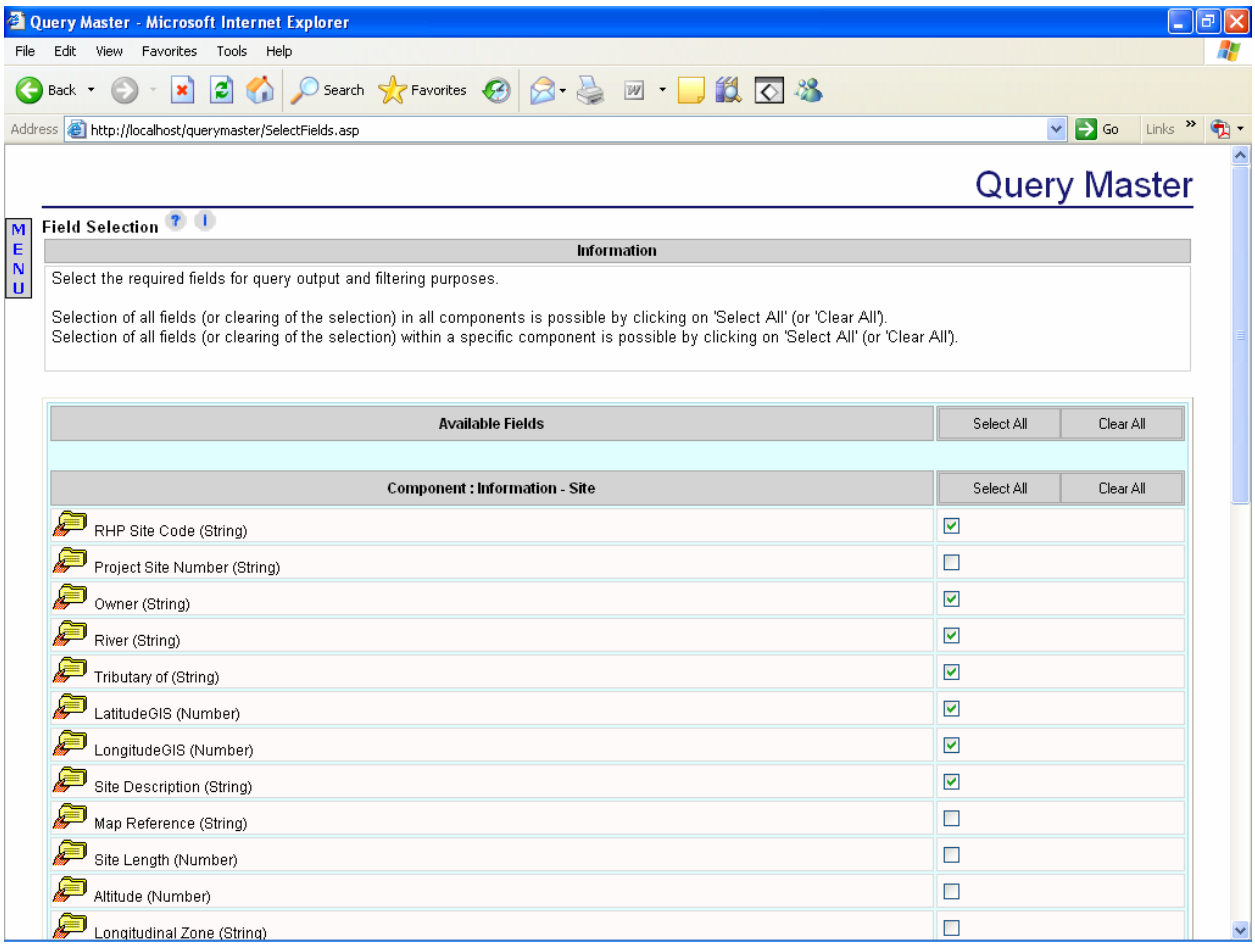
A specific query example is provided in Appendix 2 and a list of Frequently Asked Questions (FAQs) is provided in Section 6.4 to assist with any problems that may be encountered when installing or using the Query Master.


Query Master - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost/querymaster/SelectSphere.asp
Go Links
Query Master
MENU
Primary Data Component Selection
Information
Select the required Primary Data Component, then click the "Next" button.
Click on any component icon to view a list of the fields that are available within that component.
Component Name
Category
Description
Data Category
Selection
Password
Information - Site
Primary
Information that characterises the site such as RHP site code, site ownership, Site Description, River, longitudinal zone, Map Reference, Site Length, Altitude, Hydrological Type (Natural and Present-day), Associated Systems, etc.
Section A: General
N/A
Information - Site Visit
Primary
Information at site visit level including RHP Site Code, Sampling Date and Site Visit Owner. Additional spatial fields are included to facilitate filtering (e.g. River Name, Longitudinal Zone, Altitude, Political region, WMA, Ecoregion I and II, Sec and Quar catchment, Veg Type, Geol Type, Bioregion, WCMR and Rainfall Region)
Section A: General
N/A
Summary Information
Primary
Provides access to site data summarised per River and Longitudinal Zone.
River Network
N/A
User Information
Primary
Information on the contact details of registered users of the Rivers Database.
Administration
N/A
Archived Data
Primary
Data archived from previous Rivers Database (e.g. geomorphology, IHI, macrophyte and algal cover, HAM, HQI, RVI data)
Archived Data
N/A
<< Back
Next >>

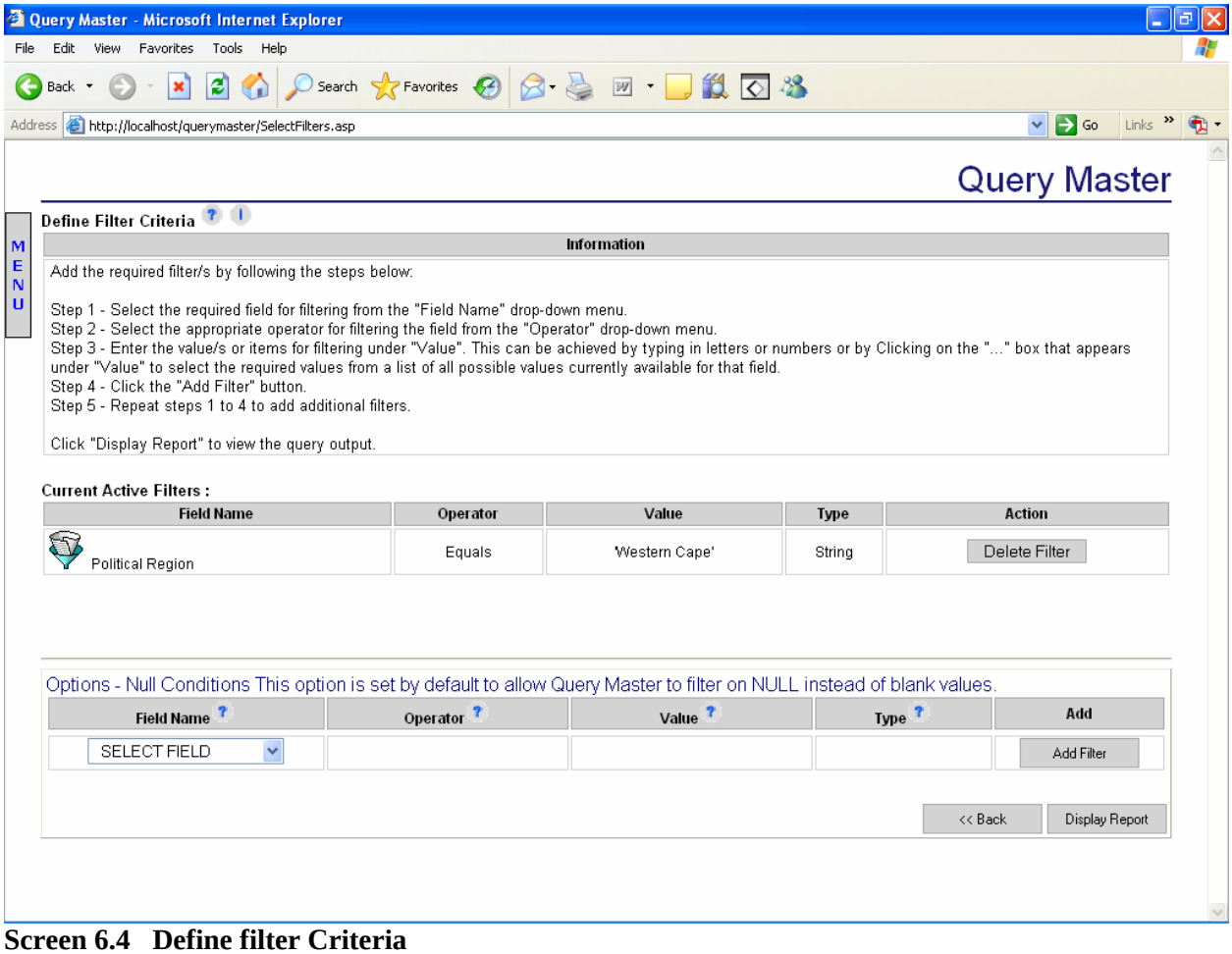
Screen 6.1 Primary Data Component Selection


Query Master - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost/querymaster/SelectJoin.asp
Go Links
Query Master
MENU
Secondary Data Component Selection (Combine Components)
Information
Select one or more of the Secondary Data Components to combine with the selected Primary Data Component, then click "Next".
If no secondary data components are required, click "Proceed without combine".
Only one of the "1-to-Many" relationship components may be selected at any one time. This is due to the nature of the relationships between the data in these components.
Primary Data Component : Information - Site.
Proceed without combine >>>
Component Name
Category
Description
Data Category
Combine ?
Relationship
Desktop Spatial Information - Site
Secondary
Information that characterises the region in which the site is located such as river, longitudinal zone, political region, WMA, Ecoregion I and II, Secondary catchment, Vegetation Type, Geological Type, etc.
Section A: General
1-to-1
Location Information - Site
Secondary
General information regarding site location details such as Land Owner and contact details.
Section A: General
1-to-1
Geo-Reference Data - Site
Secondary
Geo-reference data (longitude and latitude coordinates) in three different formats.
Section A: Geo-Reference
1-to-1
<< Back
Next >>

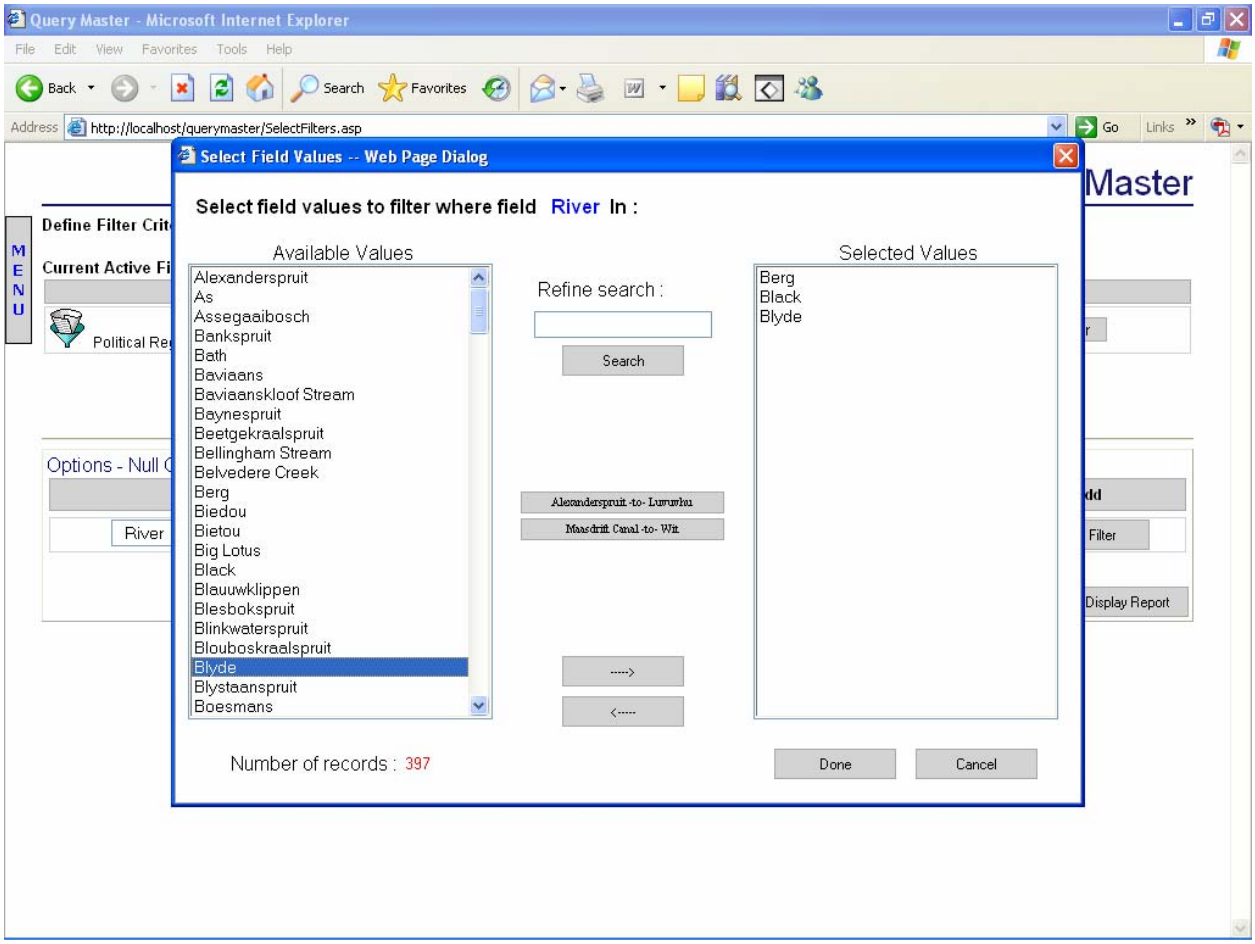
Screen 6.2 Secondary Data Component (Combine Components)


Query Master - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost/querymaster/SelectFields.asp
Go Links
Query Master
MENU
Field Selection
Information
Select the required fields for query output and filtering purposes.
Selection of all fields (or clearing of the selection) in all components is possible by clicking on 'Select All' (or 'Clear All').
Selection of all fields (or clearing of the selection) within a specific component is possible by clicking on 'Select All' (or 'Clear All').
Available Fields
Select All
Clear All
Component : Information - Site
Select All
Clear All
RHP Site Code (String)
Project Site Number (String)
Owner (String)
River (String)
Tributary of (String)
LatitudeGIS (Number)
LongitudeGIS (Number)
Site Description (String)
Map Reference (String)
Site Length (Number)
Altitude (Number)
Longitudinal Zone (String)

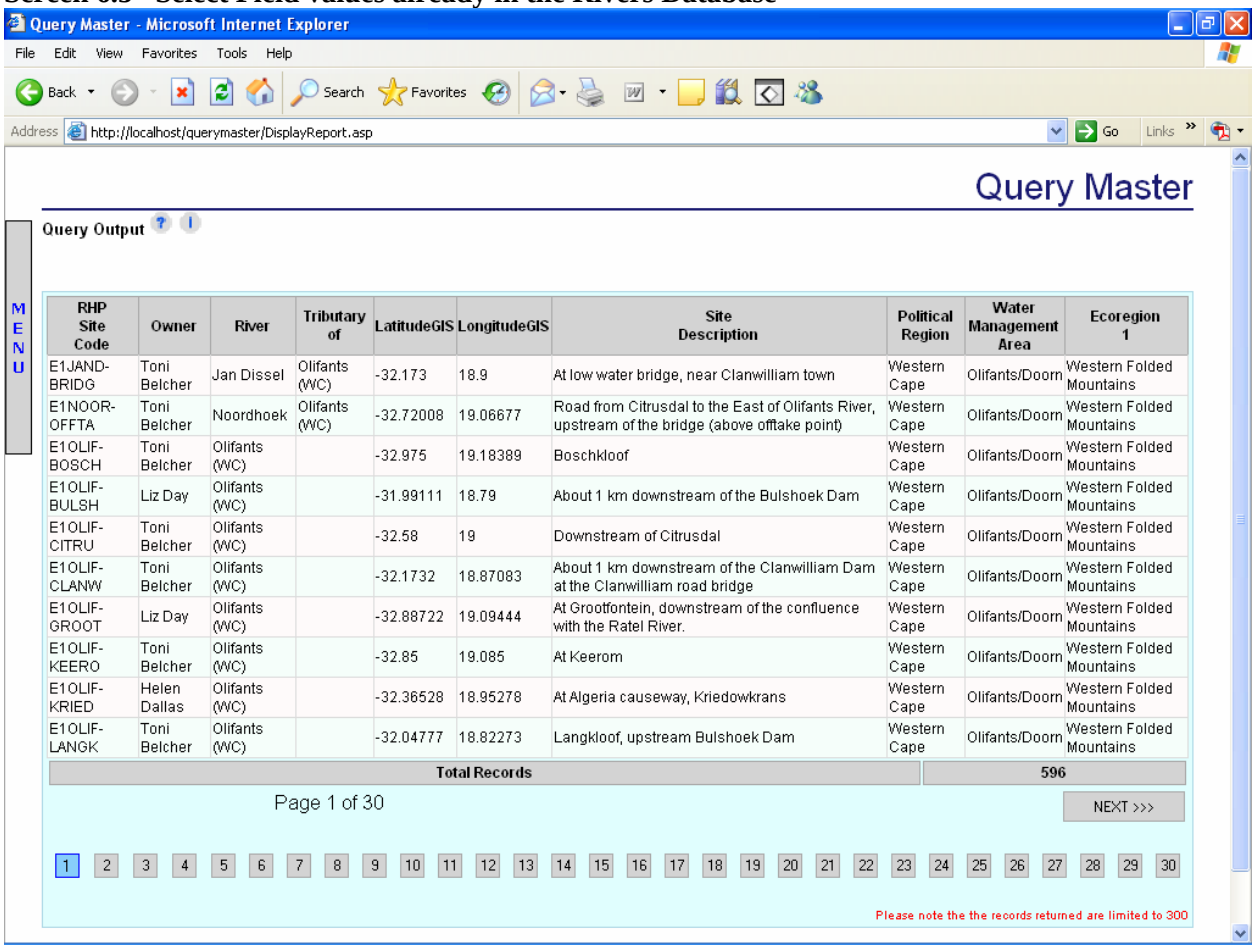
Screen 6.3 Available fields for selection


Query Master - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost/querymaster/SelectFilters.asp
Go Links
Query Master
MENU
Define Filter Criteria
Information
Add the required filter/s by following the steps below:
Step 1 - Select the required field for filtering from the "Field Name" drop-down menu.
Step 2 - Select the appropriate operator for filtering the field from the "Operator" drop-down menu.
Step 3 - Enter the value/s or items for filtering under "Value". This can be achieved by typing in letters or numbers or by Clicking on the "..." box that appears under "Value" to select the required values from a list of all possible values currently available for that field.
Step 4 - Click the "Add Filter" button.
Step 5 - Repeat steps 1 to 4 to add additional filters.
Click "Display Report" to view the query output.
Current Active Filters :
Field Name
Operator
Value
Type
Action
Political Region
Equals
'Western Cape'
String
Delete Filter
Options - Null Conditions This option is set by default to allow Query Master to filter on NULL instead of blank values.
Field Name
Operator
Value
Type
Add
SELECT FIELD
Add Filter
<< Back
Display Report

Screen 6.4 Define filter Criteria



Screen 6.5 Select Field values already in the Rivers Database



RHP Site Code	Owner	River	Tributary of	LatitudeGIS	LongitudeGIS	Site Description	Political Region	Water Management Area	Ecoregion 1
E1JAND-BRIDG	Toni Belcher	Jan Dissel	Olifants (WC)	-32.173	18.9	At low water bridge, near Clanwilliam town	Western Cape	Olifants/Doorn	Western Folded Mountains
E1NOOR-OFFTA	Toni Belcher	Noordhoek	Olifants (WC)	-32.72008	19.06677	Road from Citrusdal to the East of Olifants River, upstream of the bridge (above offtake point)	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-BOSCH	Toni Belcher	Olifants (WC)		-32.975	19.18389	Boschkloof	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-BULSH	Liz Day	Olifants (WC)		-31.99111	18.79	About 1 km downstream of the Bulshoek Dam	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-CITRU	Toni Belcher	Olifants (WC)		-32.58	19	Downstream of Citrusdal	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-CLANW	Toni Belcher	Olifants (WC)		-32.1732	18.87083	About 1 km downstream of the Clanwilliam Dam at the Clanwilliam road bridge	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-GROOT	Liz Day	Olifants (WC)		-32.88722	19.09444	At Grootfontein, downstream of the confluence with the Ratel River.	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-KEERO	Toni Belcher	Olifants (WC)		-32.85	19.085	At Keerom	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-KRIED	Helen Dallas	Olifants (WC)		-32.36528	18.95278	At Algeria causeway, Kriedowkrans	Western Cape	Olifants/Doorn	Western Folded Mountains
E1OLIF-LANGK	Toni Belcher	Olifants (WC)		-32.04777	18.82273	Langkloof, upstream Bulshoek Dam	Western Cape	Olifants/Doorn	Western Folded Mountains
Total Records								596	

Screen 6.6 Results of the query

6.3. Setting criteria

Below is a short explanation of the different operators that can be used to set criteria:

Equals	This key is used to select only one value[2] or item[3] to return records for a single value or item. For example, if **"River Name" "Equals" 'Berg'** is selected, then only records for the Berg River are returned. Compare with the operator "In".
Not Equals	This key is used to exclude a single value or item from the list of those records returned. For example, if "**River Name" "not equals" 'Berg'** is selected, then all records for all rivers are returned, excluding those associated with the Berg River. Compare with the operator "Not In".
In	This key is used when searching for more than one item. For example, if "**River Name" "In" 'Berg', 'Breede', 'Olifants'** is selected, then all records for these 3 rivers are returned. Compare with the operator "Equals".
Not In	This key is used to exclude several values or items. For example, if "**River Name" "not in" 'Berg', 'Breede', 'Olifants'** is selected, then all for all rivers are returned, excluding those associated with these 3 rivers. Compare with the operator "Not Equals".
Greater Than	This key is used to return all records where the specified field has values greater than a specified value. For example, if **"Chem value" "Greater than" '5'** is selected, then all records where the specified chemistry code has values greater than 5 will be returned.
Less Than	This key is used to return all records where the specified field has values less than a specified value. For example, if "**Chem value" "less than" '5'** is selected, then all records where the specified chemistry code has values less than 5 will be returned.
Greater Than Equal to	This key is used to return all records where the specified field has values equal to or greater than a specified value. For example, if "**Chem value" "Greater Than Equal To" '5'** is selected, then all records where the specified chemistry code has values equal to or greater than 5 will be returned.
Less Than Equal to	This key is used to return all records where the specified field has values equal to or less than a specified value. For example, if **"Chem value" "Less Than Equal To" '5'** is selected, then all records where the specified chemistry code has values equal to or less than 5 will be returned.
Starts With	This key can be used to select all items that start with a specified item or value. For example, if **"River Name" "Starts With" 'B'** is selected, then all rivers (and associated records) that start with the letter B will be returned. Filtering can be

[2] number

[3] a string (text) or a single letter

further refined by selecting more letters or values. For example, if **"River Name" "Starts With" 'Brak'** is selected, instead of selecting just 'B', then all rivers (and associated records) that start with 'Brak' will be returned.

Ends With — This key can be used to select all items that end with a specified item or value. For example, if **"River Name" "Ends With" 'E'** is selected, then all rivers (and associated records) that end with the letter E will be returned. Filtering can be further refined by selecting more letters or values. For example, if **"River Name" "Ends With" 'tjie'** is selected, instead of selecting just 'E', then all rivers (and associated records) that end with 'tjie' will be returned.

Containing — This key works in the same way as "Starts With" and "Ends With" with the exception that all records for a given field that contain a specified item or value will be returned. For example, if **"River Name" "Containing" 'B'** is selected, then all rivers (and associated records) that contain the letter 'B' in the name will be returned, regardless of where in the name the letter occurs.

6.4. Frequently asked questions – Query Master

Question	**Answer**
I get a dialog box asking me if I want to connect or work offline when I open Query Master. What must I do?	Click the "Connect" button. If you have a normal dialup internet account, then your computer might attempt to dial out for an internet connection. If this happens, then click the cancel button. LAN uses should not encounter this type of problem.
I clicked the Query Master icon, my browser window opens (Internet Explorer) but it just seems to hang. What might be the problem?	It could be that your web server (Personal Web Server or IIS) is not running or not working correctly. Another problem could be that the File System Object is corrupt or not working or it could simply be that the installation went wrong and the link is not working.
Sometimes the pages seem to contain old data from other, previously run queries. What must I do to ensure that the query runs correctly?	Press Ctrl-F5 to refresh the pages because your browser stores the pages and sometimes it is necessary to refresh these so that the query is displayed correctly.
The River Server loads in the IE window that the Query Master was in.	Open Internet Explorer: go to Tools, Options, and go to the advanced tab. Under 'Browsing' unclick "Reuse windows for launching shortcuts"
When attempting to open the query master, I am asked for a log in name and password.	Select cancel. A pop up bar indicating that you can work on the intranet appears. Right click this bar and select "work on the intranet' – you can now proceed with working through the query master.

When opening the query master I get the following message: “Unable to open Query Master” - asks for a login name	In the Internet Explorer menu bar, open 'Tools', 'Options', 'Connections', 'LAN Settings' and check the 'Bypass proxy server for local addresses' checkbox.
When I open query master and click on Primary Component and the screen freezes.	Go to “File” in menu. You’ll see that the ‘work off-line’ option in the drop down list has a tick next to it. Click the ‘work off-line’ option and the tick will disappear. You can now proceed to use the query master.
When I try to add a filter and I unable to	You need to enable Pop-Up windows. On the Tools menu click Pop-Up Blocker, Turn off Pop-Up Blocker. If you only want to allow pop-ups from the Rivers website, then on the Tools menu, point to Pop-up Blocker, and then click Pop-up Blocker Settings. In the Address of Web site to allow box, type the address (or URL) of the Web site you want to see pop-ups from, and then click Add.

7. TECHNICAL INFORMATION

7.1. Software and Hardware Requirements

- Operating System: preferably Windows 2000 or Windows XP, with Service Pack 2 installed.
- Internet Information Server must be installed on Windows 2000 or Windows XP. (To install, go to Control panel, Add or Remove programs, Add/Remove Windows Components, check the Internet Information Services checkbox and click Next. The original windows setup CD may be required to complete this task.).
- Memory: minimum of 256 MB RAM.
- Software: Microsoft Office 2000 or greater.
- Minimum Screen Resolution: 1024 x 768.
- Hard Drive: 200MB free.
- Regional Settings: Ensure that your short date format, in Control Panel: Regional Settings is set to display an acceptable date format, e.g. dd/mm/yyyy.

7.2. Installing the Rivers application

IMPORTANT: Before installing the Rivers application, please ensure Internet Information Services 5 (or greater) is installed on your computer (to check: Start/Settings/Control Panel/Add or Remove Programs/Add Remove Windows Components). If the Internet Information Services (IIS) checkbox is not checked, check the box and click 'Next'. This will require the original windows installation CD.

To Install IIS on **Vista**. Go to 'Start', 'Control Panel', 'Programs and Features' and select 'Turn Windows features on or off' on the bar on the left hand side. In the screen that pops up, check the 'Internet Information Services' checkbox. Expand the 'Internet Information Services' node (using the plus sign) and check the 'Web Management Services' and 'World Wide Web Service'. Finally, make sure that ALL check boxes under these two options are checked.

- Insert the Rivers installation CD
- The installation shield should begin automatically. If it does not, browse for setup.exe on the CD.
- Click setup.exe to start the installation process • Depending on the software already installed on your computer, you may be prompted to accept various licensing agreements from Microsoft. Click 'Accept' and follow the prompts (if an error is displayed, make sure IIS is installed, as described above).
- In some cases, it may be necessary restart the computer during the installation process. The installation process will continue automatically following the reboot.
- Once the installation is complete, the 'Rivers Client', 'Rivers Server' and 'Query Master' shortcuts will be available on you desktop and in the Start menu (Start/Programs/Rivers Database 2007).

7.3. Uninstalling the Rivers application

WARNING: Uninstalling the Rivers client application will result in the loss of all data that has not been uploaded to the Rivers server.

- Navigate to Start/Control Panel/Add Remove Programs Select 'Rivers' from the program list and click 'Remove'

7.4. User Support for the Rivers Database

Version 3.0 of the Rivers Database has been distributed to all RHP practitioners who attended the training workshops, to regional champions and other relevant authorities known to be doing biomonitoring work in South Africa. It is likely, during the course of using the database, that problems and suggestions for improvement will be noted. Users are encouraged to send comments to the Rivers Administrator (See Contact Details on the Rivers Server).

Reporting bugs or error messages

Should you come across a bug in the Rivers application, please report it by sending the following information via email to the rivers administrator, as specified under the '**Contact details**' on the rivers server.

- The date of the error
- The logged in user
- A full description of the error, including the process that resulted in the error
- A screen shot of the error (while an error is displayed on the page, click Alt and Print screen, open Paint or Microsoft Word, paste and save the image/document)

8. DOCUMENTATION

Several reports related to the Rivers Database have been published. They are available as .pdf files within the Rivers Database via the Rivers Server/Documentation/. The manual and other relevant publications are also available on the RHP website: http://www.csir.co.za/rhp

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Appendix 1. Glossary of terms used in this manual

"Navigational" sequence	The hierarchical sequence of Parent Rivers, their tributaries can be sorted either alphabetically, or according to the sequence of occurrence from source to sea. The navigational sequence is therefore the "map" of the route to navigate to a site.
Biomonitoring	"The systematic use of biological responses to evaluate (primarily anthropogenic) changes in the environment with the intent to use this information in a quality control programme" (Matthews *et al.* 1982).
Criteria	The conditions that control which records to display in a query; the words or values used to determine the data that appears in a data list.
Data "owner"	The person responsible for either site or site visit information that is entered into the database. The "ownership" of data is automatically assigned to the user who enters the data into the database. Information can only be altered or changed when the user and owner are the same.
Data "user"	The person who is logged on to the Rivers Database according to a predetermined user name and password.
Drop-down list	A predetermined list of options for a text box which limits the user to select one of these text options.
Ecological Reference Condition	This is the condition that is representative of a group of "least-impacted" or minimally disturbed habitats organised by selected physical, chemical and biological attributes (Reynoldson *et al*. 1997). It acts as a benchmark with which monitoring information can be compared thereby providing a means of estimating the degree of degradation or deviation from natural conditions.
Free text box	A box which allows the user to type whatever text is desired within that box. See drop-down list for a comparison.
Geological-type	Simplified lithostratigraphic units as defined by Vegter (1995).
Hydrological-type	Can be one of three types based on the occurrence of flowing water in the system *i.e.* perennial: flows continuously all year round; seasonal: flows annually at a predictable time of year, but ceases to flow for some time each year; and ephemeral: flows periodically every few years (Dallas 2005).
Parent river	The central or common river into which all rivers within a catchment flow.
Quaternary catchment code	A code for each quaternary drainage region as classified for South Africa by DWAF.
Secondary catchment code	A code for secondary drainage regions as classified for South Africa by DWAF.
Site level components	All information which is specific to a site but does not vary over time. *i.e.* information which is spatially defined rather then temporally defined.
Site visit components	All information which is specific to the date of collection of such information. i.e. information about a site which may vary over time.
Longitudinal zone	The geomorphological zones of river channels based on channel gradient as defined by Rowntree & Wadeson (1998).
Tick boxes	A box which is ticked when a positive action is recorded.
Vegetation-type	The potential natural vegetation of South Africa, Lesotho and Swaziland according to Low and Rebelo (1996).

Appendix 2: A step-by-step example of a query setting specific criteria.

Requirements: Provide SASS scores, ASPT scores and the Number of taxa for all site visits on all rivers which fall within secondary catchments B1, B2, and B3, where the pH is greater than 4. This query must reveal geo-reference information so that the sites can be displayed in GIS. Table A1 gives an indication of the data that should be returned in the final query output to satisfy these requirements.

Table A1 The desired query output for the specific query outlined in this section.

RHP Site code	Sampling Date	Secondary catchment code	GIS Longitude	GIS Latitude	SASS Data Version	SASS4 Score	ASPT	Number of Families	pH Values

Once the Query Master has been opened, the steps below are followed to extract the data required to meet the specifications outlined above for this example.

1 Select the correct **primary component**. In this example, the **"Information - Site Visit"** primary component is selected because it contains both site specific data (i.e. the site code and secondary catchment) and site visit specific data (i.e. sampling date).
Click "next". This opens the "Select Secondary Components" form.

2 Select appropriate **secondary components** to combine with the "**Information - Site Visit**" primary component. The following secondary components are selected:
- **"SASS scores by Site: Full data"** (contains SASS scores, ASPT and Number of families, regardless of biotopes),
- **"Chemistry: Values only"** (contains the pH values),

Click "next". This opens the "Available Field Selection" screen.

3 Tick the fields that you would like to return in the final query or *which may be required in the filtering process*. The fields are given for the primary component and each of the secondary components respectively. The following fields are ticked:

a) Primary component: Information - Site Visit:
- RHP Site code
- Sampling date
- GIS Latitude
- GIS Longitude
- Secondary Catchment Code

b) Secondary component: Chem: Values only
- pH

c) Secondary component: SASS scores by site: full data
- SASS Data Version
- SASS Score

- Number of Families
- ASPT

Click “next”. This opens the “Define Filter Criteria” screen.

4 This example specifies that data for secondary catchments B1, B2 and B3 must be returned and that data for site visits where the pH is greater than 4 must be returned. Therefore we must filter the “Secondary Catchment” and “pH” fields. To add the appropriate filters:

- Select “Secondary Catchment” from the drop-down list under “Field Name”.
- Then select “In” from the drop-down list available under “operators”.
- Click on the “….” box that appears under “Value”. This opens a list of all secondary catchment codes already entered into the database.
- Select “B1”, “B2”, and “B3” that appear in the “available fields” box on the left of the screen. Click the right arrow button or double click on these items to move them to the “selected fields” box on the right hand side of the screen. Click “done” to return to the “Define Filter Criteria” once all the codes have been selected.
- Click “Add Filter”.
- Once the filter has been added, select “pH” from the drop-list under “Field Name”.
- Then select “greater than” from the drop-down list available under “operators”.
- Type in the number 4 in the box under “Value”.
- Click “Add Filter”.

5 Click “Display Report”. This opens a screen that displays the results of the query or the query report. The final query output should be similar to the structure indicated in Table A1.

6 To export the data into MS Excel, move mouse over “Menu” bar and click “Export to excel (.csv) and “Save” the file giving it a suitable name. You can then open the file in MS Excel and analysed it further.

Appendix 3. Geological types based on Vegter (1995) giving Lithostratigraphic Unit and Principle Rock Types

Geology Code	Lithostratigraphic Unit	Principle Rock Types
CPd	Dwyka Formation	Tillite with subordinate sandstone, mudstone, shale; intruded by dolerite dykes and sheets
CPde	Dwyka Formation And Ecca Group	Tillite with sandstone, mudstone, shale; intruded by dolerite along north natal coast
Db	Bokkeveld Group	Shale, siltstone, sandstone
Dw	Witteberg Group	Quartzitic sandstone, shale, diamicite
Jdr	Drakensberg Formation	Basalt
Je	Enon Formation	Conglomerate, sandstone
Jj	Jozini Formation, Tshokwane Granophyre, Bumeni Complex	Rhyolite, granophyre, syenite, tuff, breccia, minor sedimentary rocks
JKu	Uitenhage And Suurberg Groups	Conglomerate, sandstone, mudstone, shale and subordinate basalt, tuff, breccia
Jl	Letaba Formation	Basalt; north-south trending dolerite dykes along Lebombo range
Kma	Malvernia Formation	Sandstone, conalomerate, marl
Kz	Zululand Group	Siltstone, sandstone, conglomerate
Ma	Pilansberg And Pienaars River Alkaline Complex	Foyaite, syenite, lava, tuff
Mg	Groblershoop Group	Schist, meta-quartzite, metalava
Mgg	Granite Gneiss	
Mkr	Koras Group	sandstone, quartz porphyry, basalt
Ml	Lebowa Granite Suite	Hornblende and biotite granites
Mn	Namaqua Metamorphic Complex	Gneiss, granite, metasediments, iron formation, calc-silicates, lava, tuff, volcaniclastic rocks, schist, amphibolite, charnockiti
Ms	Soutpansberg Group And Blouberg Formation	Quartizite, conglomerate, grit, sandstone, siltstone, mudstone, shale, basalt, trachy-andesite, tuff; diabase dykes/sills
Mv	Volop Group	subgreywacke, quartzite, conglomerate, shale
Mw	Waterberg Group And Glentig Formation	Conglomerate, grit, sandstone, siltstone, mudstone, shale, trachyte; quartz porphyry; diabase dykes and sills
Mwi	Wilgenhoutsdrif Group	Greenstone, phyllite, quartzite
N-C	Cape Granite Suite	Unspecified
N-E	Cape Granite Suite, Kuboos, George, Woodville Plutons	Biotite granite
Ng	Gariep Complex	Quartzite, arkose, dolomite,diamictite, phyllite, schist, gneiss, adesite, basalt, tuff
Nga	Gamtoos Formation	Phyllite, greywacke, conglomerate, sandstone, limestone

Geology Code	Lithostratigraphic Unit	Principle Rock Types
Nk	Kango Group	Sandstone, shale, conalomerate, limestone
Nka	Kaaimans Group	Quartzite, phyllite, schist
Nkf	Kuibis And Schwarzrand And Fish River Formations	Quartzite; limestone, shale; quartzite, shale
Nks	Kuibis And Schwarzrand Formations	Quartzite; limestone, shale
Nm	Malmesbury Group; Tygerberg, Franschhoek, Klipheuwel Formations; Bridgetown Complex	Shist, phyllite, phyllitic shale, shale, limestone, sandstone, greywacke, conglomerate, quartzite, greenstone
Nmp	Mapumulo Group (Mzimkulu Formation)	Gneiss, granulite (marble, dolomite, granulite)
Nr	Richtersveld Suite	Granite porphyry, biotite granite, syenite
Ntn	Tugela, Mfongozi And Ntingwe Groups And Intrusives	Conglomerate, mudstone, limestone, amphibolite, schist, gneiss, tonalite, metamorphosed mafic and ultramafic rocks
Nv	Van Rhynsdorp Group	Sandstone, shale, siltstone, limestone, dolomite, quartzite schist
OSn	Natal Group	Quartzitic sandstone, shale, arkose
OSt	Table Mountain Group	Quartizitic sandstone, subordinate shale and tillite
Pa	Adelaide Subgroup	Mudstone, sandstone; intruded by dolerite dykes and sheets
Pe	Ecca Group	Shale; intruded by dolerite dykes and sheets
Pes	Ecca Group	shale, sandstone; intruded by dolerite dykes and sheets
PTRu	Undifferentiated Karoo Sequence	Sandstone, siltstone, mudstone, shale; intruded by dolorite and includes patches of Letaba basalt north of the Soutpansberg
Q	Fluvial Deposits	Alluvium, sand, gravel
R	Houtrivier, Salisbury Kop, Mpuluzi, Gaborone, Harmony And Cunning Moor Intrusives	Biotite-muscovite granite, gneiss, leucogranite, migmatite, potassic granite, quartz monzonite, tonalite, quartz porphyry
Rd	Dominion Group	Andesite, quartz porhyry, quartzite
Rdw	Dominion Group And Witwatersrand Supergroup	Andesite, quartz porhyry, quartzite, shale, conglomerate
Rmz	Mozaan Groups	Quartzite, shale, hornfels
Rro	Rooiwater Complex	Diorite, gabbro
RV	Mashashane And Mashishimale Suites; Aderouke, Hugomond, Lekkersmaak, Mtlala, Matok, Moletsi, Palmietfontein, S	Granite, biotie-muscovite granite; diabase / dolerite dykes
RVs	Bothaville Formation Kameeldoorns Formation (Ventersdorp Supergroup)	Conglomerate, sandstone, shale
RVv	Ventersdorp Supergroup Klipriviersberg, Zoetlief, Amalia	Andesite, quartz porphyry, dacite, rhyolite, trachyte, ignimbrite, tuff, agglomerate,

Geology Code	Lithostratigraphic Unit	Principle Rock Types
	Hartswater And Sodium Groups; Hereford, Ritchie And Z	volcaniclastics, conglomorate, sandstone, ar
Rw	Witwatersrand Supergroup	Quartzite, shale, conglomerate, lava
TQc	Various Coastal Deposits	Conglomerate, sandstone, aeolianite, sand, limestone, alluvium
TQk	Kalahari Groups	Sand, calcareous sandstone, clay gravel
Trmc	Molteno, Elliot And Clarens Formations	Sandstone, siltstone, mudstone shele; intruded by dolerite dykes and sheets
TRt	Tarkastad Subgroup	Mudstone, sandstone; intruded by dolerite dykes and sheets
Trtc	Tarkastad Subgroup, Molteno, Elliot And Clarens Formations	Sandstone, stiltstone, mudstone, shale; intruded by dolerite dykes and sheets
V	Mpageni, Meinhardskraal And Unnamed Intrusives	Potassic biotite and leucocratic granites with north-easterly trending diabase / dolerite dykes
Vb	Buffelsfontein Group	Lava, volcaniclastic rocks, quartzite, greywacke ,shale
Vc	Campbell Group And Vryburg Formation	Dolomite, dolomitic limestone, chert, shale, siltstone, quartzite, andesite; diabasedolerite dykes
Vg	Groblersdal Group Dennilton And Bloempoort Formations	Lava, tuff, schist, gneiss, slate, shale, quartzite
Vgr	Griquatown Group	Mudstone, iron formation, riebeckite, jasilite; diabase / dolerite dykes
Vgwb	Godwan Formation, Wolkeberg Group And Black Reef Formation	(except where the latter is included with Malmani subgroup and Assen formation): Lava, tuff, quartzite, shale, conglomerate
Vh	Hekpoort Formation	Andesite
Vlu	Mapedi, Lucknow And Harley Formations	Andesite, tuff, conglomerate, shale, quartzite, limestone
Vm	Malmani Subgroup, Assen And Black Reef Formations	(exept where the latter is included with Godwan formation and Wolkberg group): Dolomite, chert, subordinate quartzite, conglomerat
VMdu	Dagbreek, Sultanaoord And Uitdraai Formations	Quartzite, quartz-sericite schist, amphibolite
VMlw	Loskop And Wilge River Formations	Pyroclastics, lava, quartzite,conglomerate, sandstone siltstone; grit, shale, diabase sills
VMrl	Rashoop Granophyre And Lebowa Granite Suite	Granophyre, hornblende and biotite granites
Vo	Ongeluk Formation Together With Overlying Voelwater And Underlying Makganyeni And Gamagara Formations	Andesite, dolomite, jaspilite, lava, diamictite, sandstone, quartzite, conglomerate
Vp	Pretoria Group, Duitschland, Penge And Langrant Formations	Quartzite, shale, conglomerate, iron formation, breccia, diamicitite, limestone, dolomite, and where not shown separately as Vh, a
Vro	Rooiberg Group	Rhyolite, pyroclastics
Vru	Rustenburg Layered Suite	Bronzitite, harzitite, harzhurgite, norite, pyroxenite, anorthotise, gabbro, diorite
Vrw	Rust Der Winter Formation	Sandstone, conglomerate, rhyolite
Vt	Pretoria And Chuniespoort Groups	Quartzite, shale, dolomite

Geology Code	Lithostratigraphic Unit	Principle Rock Types
Z	Nelspruit, Dalmein, Hebron, Halfway House, Goudplaats And Unnamed Intrusives	Granite, granodiorite, tonalite, gneiss, migmatite
Zba	Barberton Sequence	Sandstone, shale, conglomerate, greywacke, lava, pyroclastic rocks
Zg	Gravelotte Group	Ultramafic, mafic and acid lava, tuff, schist, conglomerate, quartzite
Zgi	Giyani Group	Ultramafic and mafic lavas, schist
Zk	Kraaipan Group	Chert, iron formation, jasilite, schist, lava
Zl	Limpopo Mobile Belt Sand River Gneiss; Beit Bridge Complex; Messina Suite; Bulai Gneiss	Migmatite, gneiss; meta-quartzite, meta-pelite, marble, calc-silicate rocks, amphibolite; meta-anorthosite, serpentinite, meta-pyr
Zng	Nondweni Group And Intrusives	Greenstone, amphibolite, granulite, potassic granite, granodiorite
ZnRu	Nsuze Group And Usushwana Complex	Basalt, andesite, quartzite; gabbro, granite
Zns	Nsuze Group	Basalt, andesite, quartzite
Zp	Pietersburg Group	Ultramafic and mafic lavas, quartzite, conglomerate, chloriteschist
ZRmg	Marydale Group Prieska And Doornfontein Subgroups; Skalkseput And Draghoender Intrusives	Conglomerate, subgreywacke, lava, tuff amphibolite, iron formation; biotite-muscovite granite, granite gneiss
ZRp	Polgola Sequence Nsuze And Mozaan Groups	Basalt, andesite, quartzite, shale, hornfels
ZRpau	Pongola Sequence Nsuze And Mozaan Groups	Basalt, andesite, quartzite, shale, hornfels; rhyolite, dacite; gabbro, granite
Zu	Unnamed	Migmatite, gneiss, ultramafics, amphibolite, acid lava, sedimentary rocks

Appendix 4. Water Chemistry codes giving the description, units, expected minimum and maximum values.

Chem Code	Description	Unit	Minimum	Maximum
AL	Aluminium concentration	mg/l	0.02	320
AL-DISS	Aluminium - Dissolved	mg/l	0.02	0.5
AL-H	Aluminium - Acid extractable	mg/l	0.009	350
AS	Arsenic	mg/l	0.03	0.5
AS-DISS	Arsenic -Dissolved	mg/l	0.03	0.5
AS-H	Arsenic - Acid extractable	mg/l	0.03	0.5
B	Boron	mg/l	0.002	0.5
BA	Barium	mg/l	0.002	0.5
BA-DISS	Barium - Dissolved	mg/l	0.002	0.5
BA-H	Barium - Acid extractable	mg/l	0.002	0.5
B-DISS	Boron -Dissolved	mg/l	0.002	0.5
BE	Beryllium	mg/l	0.001	0.005
BE-DISS	Beryllium - Dissolved	mg/l	0.001	0.005
BE-H	Beryllium - Acid extractable	mg/l	0.001	0.005
B-H	Boron - Acid extractable	mg/l	0.002	0.5
CA	Calcium	mg/l	0	500
CaCO3	Alkalinity as Calcium Carbonate	mg/l	0	500
CD	Cadmium	mg/l	0.001	0.15
CD-DISS	Cadmium - Dissolved	mg/l	0.001	0.15
CD-H	Cadmium - Acid extractable	mg/l	0.001	0.15
CL	Chloride	mg/l	0	1000
CO	Cobolt	mg/l	0.001	0.05
CO-DISS	Cobolt - Dissolved	mg/l	0.001	0.05
CO-H	Cobolt - Acid extractable	mg/l	0.001	0.05
COND	Conductivity	mS/m	1	500
CR	Chromium	mg/l	0.001	0.5
CR-DISS	Chromium - Dissolved	mg/l	0.001	0.5
CR-H	Chromium - Acid extractable	mg/l	0.001	0.5
CU	Copper	mg/l	0.001	0.1
CU-DISS	Copper - Dissolved	mg/l	0.001	0.1
CU-H	Copper - Acid extractable	mg/l	0.001	0.1
DO	Dissolved oxygen	mg/l	1	15
DOC	Dissolved Organic Carbon	mg/l		
DOPER	% saturation of oxygen dissolved in the water	%	10	150
ECOLI	Faecal Coliforms (*E. Coli*)			
F	Flourine	mg/l	0.1	5
FE	Iron	mg/l	0.0001	50
FE-DISS	Iron - Dissolved	mg/l	0.0001	1
FE-H	Iron - Acid extractable	mg/l	0.0001	50
HG	Mercury	mg/l	0.01	1
HG-H	Mercury - Acid extractable	mg/l	0.01	1
K	Potassium	mg/l	0.0001	100
KN	Kjeldahl Nitrogen	mg/l	0.04	1
MG	Magnesium	mg/l	0.1	150
MN	Manganese	mg/l	0.001	20
MN-DISS	Manganese - Dissolved	mg/l	0.001	20
MN-H	Manganese - Acid extractable	mg/l	0.001	20

Chem Code	Description	Unit	Minimum	Maximum
MO	Molybdenum	mg/l	0.005	0.5
MO-DISS	Molybdenum - Dissolved	mg/l	0.005	0.5
MO-H	Molybdenum - Acid extractable	mg/l	0.005	0.5
NA	Sodium	mg/l	1	500
NH4-N	Ammonia nitrogen	mg/l	0.0001	10
NI	Nickel	mg/l	0.004	1
NI-DISS	Nickel - Dissolved	mg/l	0.004	1
NI-H	Nickel - Acid extractable	mg/l	0.004	1
NO2-N	Nitrite nitrogen	mg/l	0.0007	0.5
NO3+NO2-N	Nitrate + Nitrite Nitrogen	mg/l	0.04	5
NO3-N	Nitrate nitrogen	mg/l	0.0001	1
ORGS	Organic fraction in TSS	mg/l	0	100
PB	Lead concentration	mg/l	0.0001	0.15
PB-DISS	Lead - Dissolved	mg/l	0.001	0.15
PB-H	Lead - Acid extractable	mg/l	0.001	0.15
PH	pH	pH unit	2	10
PHEN	Phenols	mg/l	0.001	0.1
PO4-P	Orthophosphate	mg/l	0.005	1
REDOX	Redox	MV	10	300
SALINITY	Salinity			
SI	Silicates	mg/l	0.01	35
SO4	Sulphate	mg/l	0.01	2000
SR	Strontium	mg/l	0.001	5
SR-DISS	Strontium - Dissolved	mg/l	0.001	5
SR-H	Strontium - Acid extractable	mg/l	0.001	5
SRP	Soluble reactive phosphorus (often assumed = PO4-P)	mg/l	0.0001	1
TAL	Total alkalinity	meq/l	0.01	5
TDS	Total dissolved solids	mg/l	1	5000
TEMP	Temperature	oC	5	35
TI	Titanium	mg/l	0.001	0.1
TI-DISS	Titanium - Dissolved	mg/l	0.001	0.1
TI-H	Titanium - Acid extractable	mg/l	0.001	0.1
TP	Total Phosphate	mg/l	0.005	0.5
TSS	Total suspended solids	mg/l	0.0001	50
TURB	Turbidity (NTU scale)	NTU	0	100
V	Vanadium	mg/l	0.002	0.1
V-DISS	Vanadium - Dissolved	mg/l	0.002	0.1
V-H	Vanadium - Acid extractable	mg/l	0.002	0.1
ZN	Zinc	mg/l	0.003	1.5
ZN-DISS	Zinc - Dissolved	mg/l	0.003	1.5
ZN-H	Zinc - Acid extractable	mg/l	0.003	1.5
ZR	Zirconium	mg/l	0.001	0.05
ZR-DISS	Zirconium - Dissolved	mg/l	0.001	0.05
ZR-H	Zirconium - Acid extractable	mg/l	0.001	0.05

Appendix 5. Fish codes

Code	Scientific Name	Common Name	Family	Status
Aben	Anguilla bengalensis	Eel	Anguillidae	
Aber	Acanthopagrus berda (Forsskål, 1775)	Riverbream (Ms)	Sparidae	Native
Ahil	Amarginops hildae (Bell-Cross, 1973)	Hilda'S Grunter	Claroteidae	
Anaa	Ambassis natalensis Gilchrist & Thompson, 1908	Slender Glassy (Ms)	Ambassidae	
Apro	Ambassis productus Guichenot, 1866	Longspine Glassy (Ms)	Ambassidae	
Alat	Amphilius laticaudatus Skelton, 1984	Broadtail Mountain Catfish	Amphiliidae	
Anat	Amphilius natalensis Boulenger, 1917	Natal Mountain Catfish	Amphiliidae	Native
Aura	Amphilius uranoscopus (Pfeffer, 1889)	Stargazer (Mountain Catfish)	Amphiliidae	Native
Alab	Anguilla bengalensis labiata Peters, 1852	African Mottled Eel	Anguillidae	
Abic	Anguilla bicolor bicolor McClelland, 1844	Shortfin Eel	Anguillidae	
Amar	Anguilla marmorata Quoy & Gaimard 1824	Giant Mottled Eel	Anguillidae	Native
Amos	Anguilla mossambica Peters 1852	Longfin Eel	Anguillidae	Native
Ahut	Aplocheilichthys hutereaui (Boulenger, 1913)	Meshscaled Topminnow	Cyprinodontidae	
Ajoh	Aplocheilichthys johnstoni (Günther, 1893)	Johnston'S Topminnow	Cyprinodontidae	
Akat	Aplocheilichthys katangae (Boulenger, 1912)	Striped Topminnow	Cyprinodontidae	Native
Amya	Aplocheilichthys myaposae (Boulenger, 1908)	Natal Topminnow	Cyprinodontidae	
Acal	Astatotilapia calliptera (Günther, 1893)	Eastern Happy	Cichlidae	
Aort	Astyanax orthodus	(Ex)	Hepsetidae	
Abre	Atherina breviceps Valenciennes, 1835	Cape Silverside	Atherinidae	
Alac	Atherinomorus lacunosus (Forster, 1801)	Hardyhead Silverside	Atherinidae	
Abar	Austroglanis barnardi (Skelton, 1981)	Barnard'S Rock Catfish	Austroglanididae	
Agil	Austroglanis gilli (Barnard, 1943)	Clanwilliam Rock-Catfish	Austroglanididae	
Ascl	Austroglanis sclateri (Boulenger, 1901)	Rock-Catfish	Austroglanididae	Native
Aaen	Awaous aeneofuscus (Peters 1852)	Freshwater Goby (M)	Gobiidae	Native
Agui	Awaous guineensis (Peters, 1876)	Brown Goby (M)	Gobiidae	
Baen	Barbus aeneus (Burchell, 1822)	Smallmouth Yellowfish	Cyprinidae	
Bafr	Barbus afrohamiltoni Crass, 1960	Hamilton'S Barb	Cyprinidae	Native
Bafo	Barbus afrovernayi Nichols & Boulton, 1927	Spottail Barb	Cyprinidae	
Bama	Barbus amatolicus Skelton, 1990	Amatola Barb	Cyprinidae	

Code	Scientific Name	Common Name	Family	Status
Band	Barbus andrewi Barnard, 1937	Whitefish	Cyprinidae	
Bann	Barbus annectens Gilchrist & Thompson, 1917	Broadstriped Barb	Cyprinidae	Native
Bano	Barbus anoplus Weber, 1897	Chubbyhead Barb	Cyprinidae	Native
Barg	Barbus argenteus Günther, 1868	Rosefin Barb	Cyprinidae	Native
Batk	Barbus atkinsoni Bailey, 1969	Dash-Dot Barb	Cyprinidae	
Bbar	Barbus barnardi Jubb, 1965	Blackback Barb	Cyprinidae	
Bbao	Barbus barotseensis Pellegrin, 1920	Barotse Barb	Cyprinidae	
Bbel	Barbus bellcrossi Jubb, 1964	Gorgeous Barb	Cyprinidae	
Bbif	Barbus bifrenatus Fowler, 1935	Hyphen Barb	Cyprinidae	Native
Bbre	Barbus breviceps Trewavas, 1936	Shorthead Barb	Cyprinidae	Native
Bbrv	Barbus brevidorsalis Boulenger, 1915	Dwarf Barb	Cyprinidae	
Bbri	Barbus brevipinnis Jubb, 1966	Shortfin Barb	Cyprinidae	
Bcal	Barbus calidus Barnard, 1938	Clanwilliam Redfin	Cyprinidae	
Bcap	Barbus capensis Smith, 1841	Clanwilliam Yellowfish	Cyprinidae	
Bcho	Barbus choloensis Norman, 1925.	Silver Barb	Cyprinidae	
Bcod	Barbus codringtonii Boulenger, 1908	Upper Zambezi Yellowfish	Cyprinidae	
Bdor	Barbus dorsolineatus Trewavas, 1936	Topstripe Barb	Cyprinidae	
Beru	Barbus erubescens Skelton, 1974	Twee River Redfin	Cyprinidae	
Beut	Barbus eutaenia Boulenger, 1904	Orangefin Barb	Cyprinidae	Native
Bfas	Barbus fasciolatus Günther, 1868	Red Barb	Cyprinidae	
Bgur	Barbus gurneyi Günther, 1868	Redtail Barb	Cyprinidae	
Bhaa	Barbus haasianus David, 1936	Sicklefin Barb	Cyprinidae	
Bhos	Barbus hospes Barnard, 1938	Namaqua Barb	Cyprinidae	
Bker	Barbus kerstenii Peters, 1868	Redspot Barb	Cyprinidae	
Bkes	Barbus kessleri (Steindachner, 1866)	Gillbar Barb	Cyprinidae	
Bkim	Barbus kimberleyensis Gilchrist & Thompson, 1913	Largemouth Yellowfish	Cyprinidae	
Blin	Barbus lineomaculatus Boulenger, 1903	Line-Spotted Barb	Cyprinidae	Native
Bmac	Barbus macrotaenia Worthington, 1933	Broadband Barb	Cyprinidae	
Bman	Barbus manicensis Pellegrin, 1919	Yellow Barb	Cyprinidae	
Bmar	Barbus marequensis Smith, 1841	Largescale Yellowfish	Cyprinidae	Native
Bmat	Barbus mattozi Guimaraes, 1884	Papermouth	Cyprinidae	Native
Bmio	Barbus miolepis Boulenger, 1902	Zig-Zag Barb	Cyprinidae	

Code	Scientific Name	Common Name	Family	Status
Bmot	Barbus motebensis Steindachner, 1894	Marico Barb	Cyprinidae	Native
Bmul	Barbus multilineatus Worthington, 1933	Copperstripe Barb	Cyprinidae	
Bnat	Barbus natalensis Castelnau, 1861	Scaly	Cyprinidae	
Bnee	Barbus neefi Greenwood, 1962	Sidespot Barb	Cyprinidae	Native
Bpal	Barbus pallidus Smith, 1841	Goldie Barb	Cyprinidae	
Bpau	Barbus paludinosus Peters, 1852	Straightfin Barb	Cyprinidae	
Bpoe	Barbus poechii Steindachner, 1911	Dashtail Barb	Cyprinidae	
Bpol	Barbus polylepis Boulenger, 1907	Smallscale Yellowfish	Cyprinidae	Native
Brad	Barbus radiatus Peters, 1853	Beira Barb	Cyprinidae	Native
Bser	Barbus serra Peters, 1864	Sawfin	Cyprinidae	
Btha	Barbus thamalakanensis Fowler, 1935	Thamalakane Barb	Cyprinidae	
Btop	Barbus toppini Boulenger, 1916	East-Coast Barb	Cyprinidae	Native
Btre	Barbus treurensis Groenewald, 1958	Treur River Barb	Cyprinidae	Native
Btrv	Barbus trevelyani Günther, 1877	Border Barb	Cyprinidae	
Btri	Barbus trimaculatus Peters, 1852	Threespot Barb	Cyprinidae	Native
Buni	Barbus unitaeniatus Günther, 1866	Longbeard Barb	Cyprinidae	Native
Bviv	Barbus viviparus Weber, 1897	Bowstripe Barb	Cyprinidae	Native
Bleb	Batanga lebretonis (Steindachner, 1870)	Deep Sleeper (Ms)	Eleotridae	
Bimb	Brycinus imberi (Peters, 1852)	Imberi	Characidae	Native
Blat	Brycinus lateralis (Boulenger, 1900)	Striped Robber	Characidae	
Cfre	Caecomastacembelus frenatus (Boulenger, 1901)	Longtail Spinyeel	Mastacembelidae	
Cshi	Caecomastacembelus shiranus (Günther, 1896)	Malawi Spinyeel	Mastacembelidae	
Cvan	Caecomastacembelus vanderwaali (Skelton, 1976)	Ocellate Spinyeel	Mastacembelidae	
Caur	Carassius auratus (Linnaeus, 1758)	Goldfish (Ex)	Cyprinidae	
Ccar_Dup	Carcharhinus leucas (Valenciennes, 1839)	Bull Shark (M)	Carcharhinidae	
Cbre	Chetia brevis Jubb, 1968	Orange-Fringed Largemouth	Cichlidae	Native
Cfla	Chetia flaviventris Trewavas, 1961	Canary Kurper	Cichlidae	Native
Cgra	Chetia gracilis (Greenwood, 1984)	Slender Happy	Cichlidae	
Cwel	Chetia welwitschi (Boulenger, 1898)	Angolan Happy	Cichlidae	
Cano	Chiloglanis anoterus Crass, 1960	Pennant-Tail Suckermouth (Or Rock Catlet)	Mochokidae	Native
Cbif	Chiloglanis bifurcus Jubb & le Roux, 1969	Incomati Suckermouth (Or Rock Catlet)	Mochokidae	Native
Cema	Chiloglanis emarginatus Jubb & le Roux, 1969	Pongolo Suckermouth (Or Rock Catlet)	Mochokidae	

Code	Scientific Name	Common Name	Family	Status
Cfas	Chiloglanis fasciatus Pellegrin, 1936	Okavango Suckermouth (Or Rock Catlet)	Mochokidae	
Cneu	Chiloglanis neumanni Boulenger, 1911	Neumann'S Suckermouth (Or Rock Catlet)	Mochokidae	
Cpar	Chiloglanis paratus Crass, 1960	Sawfin Suckermouth (Or Rock Catlet)	Mochokidae	Native
Cpre	Chiloglanis pretoriae van der Horst, 1931	Shortspine Suckermouth (Or Rock Catlet)	Mochokidae	Native
Cswi	Chiloglanis swierstrai van der Horst, 1931	Lowveld Suckermouth (Or Rock Catlet)	Mochokidae	Native
Cpla	Clariallabes platyprosopos Jubb, 1964	Broadhead Catfish	Clariidae	
Ccav	Clarias cavernicola Trewavas, 1936	Cave Catfish	Clariidae	
Cgar	Clarias gariepinus (Burchell, 1822)	Sharptooth Catfish	Clariidae	Native
Clio	Clarias liocephalus Boulenger, 1898	Smoothhead Catfish	Clariidae	
Cnga	Clarias ngamensis Castelnau, 1861	Blunttooth Catfish	Clariidae	
Csta	Clarias stappersii Boulenger, 1915	Blotched Catfish	Clariidae	
Cthe	Clarias theodorae Weber, 1897	Snake Catfish	Clariidae	
Csup	Clinus superciliosus (Linnaeus, 1758)	Super Klipfish (Ms)	Clinidae	
Cwit	Coptostomabarbus wittei David & Poll, 1937	Upjaw Barb	Cyprinidae	
Cmos	Croilia mossambica Smith, 1955	Burrowing Goby (M)	Gobiidae	
Cide	Ctenopharyngodon idella (Valenciennes, 1844)	Grass Carp (Ex)	Cyprinidae	Introduced
Cmul	Ctenopoma multispine Peters, 1844	Manyspined Climbing Perch	Anabantidae	
Ccar	Cyprinus carpio Linnaeus, 1758	Carp (Ex)	Cyprinidae	Introduced
Dmos	Distichodus mossambicus Peters, 1852	Nkupe	Distichodontidae	
Dsch	Distichodus schenga Peters, 1852	Chessa	Distichodontidae	
Efus	Eleotris fusca (Schneider, 1801)	Dusky Sleeper (Ms)	Eleotridae	
Emel	Eleotris melanosoma Bleeker, 1852	Broadhead Sleeper (Ms)	Eleotridae	
Evit	Eleotris vittata Duméril, 1858	Striped Sleeper (Ms)	Eleotridae	
Gzeb	Galaxias zebratus Castelnau, 1861	Cape Galaxias	Galaxiidae	
Gaff	Gambusia affinis (Baird & Girard, 1853)	Mosquitofish (Ex)	Poeciliidae	Introduced
Gaes	Gilchristella aestuaria (Gilchrist, 1913)	Estuarine Round-Herring	Clupeidae	
Gcal	Glossogobius callidus Smith, 1937	River Goby (M)	Gobiidae	Native
Ggiu	Glossogobius giuris (Hamilton-Buchanan, 1822)	Tank Goby (M)	Gobiidae	Native
Glep	Gobionellus lepturus Pfaff, 1933	Slender Goby	Gobiidae	
Helo	Hemichromis elongatus (Guichenot, 1859)	Banded Jewelfish	Cichlidae	
Hmac	Hemigrammocharax machadoi Poll, 1967	Dwarf Citharine	Distichodontidae	
Hmul	Hemigrammocharax multifasciatus Boulenger, 1923	Multibar Citharine	Distichodontidae	

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Hbar	Hemigrammopetersius barnardi (Herre, 1936)	Barnard'S Robber	Characidae	
Hodo	Hepsetus odoe (Bloch, 1794)	African Pike	Hepsetidae	
Hlon	Heterobranchus longifilis Valenciennes, 1840	Vundu	Clariidae	
Hans	Hippopotamyrus ansorgii (Boulenger,1905)	Slender Stonebasher	Mormyridae	
Hdis	Hippopotamyrus discorhynchus (Peters, 1852)	Zambezi Parrotfish	Mormyridae	
Hvit	Hydrocynus vittatus Castelnau, 1861	Tigerfish	Characidae	Native
Hmol	Hypophthalmichthys molitrix (Valenciennes, 1844)	Silver Carp (Ex)	Cyprinidae	Introduced
Hcap	Hyporhamphus capensis (Thominot, 1886)	Cape Halfbeak (Ms)	Hemirhamphidae	
Hday	Hypseleotris dayi Smith, 1950	Golden Sleeper (M)	Eleotridae	
Hjub	Hypsopanchax jubbi Poll & Lambert, 1965	Southern Deepbody	Cyprinodontidae	
Kang	Kneria angolensis Steindachner, 1866	Angola Kneria	Kneriidae	
Kaur	Kneria auriculata (Pellegrin, 1905)	Southern Kneria	Kneriidae	Native
Kmay	Kneria maydelli Ladiges & Voelker, 1961	Cunene Kneria	Kneriidae	
Kpol	Kneria polli Trewavas, 1936	Northern Kneria	Kneriidae	
Krup	Kuhlia rupestris (Lacepède, 1801)	Rock Flagtail (Ms)	Kuhliidae	
Lalt	Labeo altivelis Peters, 1852	Manyame Labeo	Cyprinidae	
Lans	Labeo ansorgii Boulenger, 1907	Cunene Labeo	Cyprinidae	
Lcap	Labeo capensis (Smith, 1841)	Orange River Labeo	Cyprinidae	
Lcon	Labeo congoro Peters, 1852	Purple Labeo	Cyprinidae	Native
Lcyl	Labeo cylindricus Peters, 1852	Redeye Labeo	Cyprinidae	Native
Llun	Labeo lunatus Jubb, 1963	Upper Zambezi Labeo	Cyprinidae	
Lmol	Labeo molybdinus du Plessis, 1963	Leaden Labeo	Cyprinidae	Native
Lros	Labeo rosae Steindachner, 1894	Rednose Labeo	Cyprinidae	Native
Lrub	Labeo rubromaculatus Gilchrist & Thompson, 1913	Tugela Labeo	Cyprinidae	
Lrud	Labeo ruddi Boulenger, 1907	Silver Labeo	Cyprinidae	Native
Lsee	Labeo seeberi Gilchrist & Thompson, 1911	Clanwilliam Sandfish	Cyprinidae	
Lumb	Labeo umbratus (Smith, 1841)	Moggel	Cyprinidae	Native
Lmac_Dup	Lepomis macrochirus Rafinesque, 1819	Bluegill Sunfish (Ex)	Centrarchidae	
Lrot	Leptoglanis rotundiceps (Hilgendorf, 1905)	Spotted Sand Catlet	Amphiliidae	
Lcho	Leptoglanis sp.	Chobe Sand Catlet	Amphiliidae	
Lmio	Limnothrissa miodon (Boulenger, 1906)	Kapenta (Ex)	Clupeidae	
Lfal	Liza falcipinnis (Valenciennes, 1836)	Sickle-Fin Mullet (Ms)	Mugilidae	

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Lmac	Liza macrolepis (Smith, 1846)	Large-Scale Mullet (Ms)	Mugilidae	Introduced
Lric	Liza richardsonii (Smith, 1846)	Southern Mullet (Ms)	Mugilidae	
Larg	Lutjanus argentimaculatus (Forsskål, 1775)	River Snapper (Ms)	Lutjanidae	
Mele	Malapterurus electricus (Gmelin, 1789)	Electric Catfish	Malapteruridae	
Mmac	Marcusenius macrolepidotus (Peters, 1852)	Bulldog	Mormyridae	Native
Mcyp	Megalops cyprinoides (Broussonet, 1782)	Oxeye Tarpon	Megalopidae	
Mbre	Mesobola brevianalis (Boulenger, 1908)	River Sardine	Cyprinidae	Native
Macu	Micralestes acutidens (Peters, 1852)	Silver Robber	Characidae	Native
Mint	Micro Ctenopoma intermedium (Pellegrin, 1920)	Blackspot Climbing Perch	Anabantidae	
Mbra	Microphis brachyurus Bleeker, 1853	Opossum Pipefish (M)	Syngnathidae	
Mflu	Microphis fluviatilis (Peters, 1852)	Freshwater Pipefish (M)	Syngnathidae	
Mdol	Micropterus dolomieu Lacepède, 1802	Smallmouth Bass (Ex)	Centrarchidae	Introduced
Mpun	Micropterus punctulatus (Rafinesque, 1819)	Spotted Bass (Ex)	Centrarchidae	
Msal	Micropterus salmoides (Lacepède, 1802)	Largemouth Bass (Ex)	Centrarchidae	Introduced
Marg	Monodactylus argenteus (Linnaeus, 1758)	Natal Moony (Ms)	Monodactylidae	
Mfal	Monodactylus falciformis Lacepède, 1801	Cape Moony (Ms)	Monodactylidae	
Mang	Mormyrops anguilloides (Linnaeus, 1758)	Cornish Jack	Mormyridae	
Mlac	Mormyrus lacerda Castelnau, 1861	Western Bottlenose	Mormyridae	
Mlon	Mormyrus longirostris Peters, 1852	Eastern Bottelnose	Mormyridae	
Mcep	Mugil cephalus Linnaeus, 1758	Flathead Mullet (M)	Mugilidae	
Mdur	Mugilogobius durbanensis (Barnard, 1927)	Durban Goby	Gobiidae	
Mcap	Myxus capensis (Valenciennes, 1836)	Freshwater Mullet (M)	Mugilidae	
Nmac	Nannocharax macropterus Pellegrin, 1925	Broadbarred Citharine	Distichodontidae	
Nans	Nematogobius ansorgii Boulenger, 1910	Spotfin Goby (Ms)	Gobiidae	
Nloz	Neolebias lozii Winemiller & Kelso-Winemiller, 199	Banded Neolebias	Distichodontidae	
Ncap	Nothobranchius sp.	Caprivi Killifish	Aplocheilidae	
Nfur	Nothobranchius furzeri Jubb, 1971	Turquoise Killifish	Aplocheilidae	
Nkaf	Nothobranchius kafuensis Wildekamp & Rosenstock, 1	Kafue Killifish	Aplocheilidae	
Nkuh	Nothobranchius kuhntae (Ahl, 1926)	Beira Killifish	Aplocheilidae	
Nort	Nothobranchius orthonotus (Peters, 1844)	Spotted Killifish	Aplocheilidae	Native
Nrac	Nothobranchius rachovii Ahl, 1926	Rainbow Killifish	Aplocheilidae	Native
Ofer	Omobranchus ferox (Herre, 1927)	Gossamer Blenny (Ms)	Blenniidae	

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Omyk	Oncorhynchus mykiss (Walbaum, 1792)	Rainbow Trout (Ex)	Salmonidae	Introduced
Oper	Opsaridium peringueyi (Gilchrist & Thompson, 1913)	Southern Barred Minnow	Cyprinidae	Native
Otwe	Opsaridium tweddleorum	Dwarf Sanjika	Cyprinidae	
Ozam	Opsaridium zambezense (Peters, 1852)	Barred Minnow	Cyprinidae	
Omac	Oreochromis (Nyasalapia) macrochir (Boulenger, 191	Greenhead Tilapia	Cichlidae	
Oand	Oreochromis andersonii (Castelnau, 1861)	Threespot Tilapia	Cichlidae	
Oaur	Oreochromis aureus (Steindachner, 1864)	Israeli Tilapia (Ex)	Cichlidae	
Omor	Oreochromis mortimeri (Trewavas, 1966)	Kariba Tilapia	Cichlidae	
Omos	Oreochromis mossambicus (Peters, 1852)	Mozambique Tilapia	Cichlidae	Native
Onil	Oreochromis niloticus (Linnaeus, 1758)	Nile Tilapia (Ex)	Cichlidae	
Opla	Oreochromis placidus (Trewavas, 1941)	Black Tilapia	Cichlidae	
Oshi	Oreochromis shiranus (Boulenger, 1896)	Shire Tilapia	Cichlidae	
Psil	Pandaka silvana (Barnard, 1943)	Dwarfgoby (Ms)	Gobiidae	
Pfor	Parakneria fortuita Penrith, 1973	Cubango Kneria	Kneriidae	
Pmos	Parakneria mossambica Jubb & Bell-Cross, 1974	Gorongoza Kneria	Kneriidae	
Pjac	Paramormyrops jacksoni (Poll, 1967)	Ghost Stonebasher	Mormyridae	
Pnga	Parauchenoglanis ngamensis (Boulenger, 1911)	Zambezi Grunter	Claroteidae	
Pflu	Perca fluviatilis Linnaeus, 1758	European Perch (Ex)	Percidae	
Pcat	Petrocephalus catostoma (Günther, 1866)	Churchill	Mormyridae	Native
Pcau	Phalloceros caudimaculatus (Hensel, 1868)	Spottail Mosquitofish (Ex)	Poeciliidae	
Pacu	Pharyngochromis acuticeps (Steindachner, 1866)	Zambezi Bream	Cichlidae	
Pret	Poecilia reticulata Peters, 1859	Guppy (Ex)	Poeciliidae	
Pcas	Pollimyrus castelnaui (Boulenger, 1911)	Dwarf Stonebasher	Mormyridae	
Pmic	Pristis microdon Latham, 1794	Smalltooth Sawfish (M)	Pristidae	
Pamp	Protopterus amphibius (Peters, 1844)	East Coast Lungfish	Protopteridae	
Pann	Protopterus annectens brieni Poll,1961	Lungfish	Protopteridae	
Pafe	Pseudobarbus afer (Peters, 1864)	Eastern Cape Redfin	Cyprinidae	
Pasp	Pseudobarbus asper (Boulenger, 1911)	Smallscale Redfin	Cyprinidae	
Pbur	Pseudobarbus burchelli Smith, 1841	Burchell'S Redfin	Cyprinidae	
Pbug	Pseudobarbus burgi (Boulenger, 1911)	Berg River Redfin	Cyprinidae	
Pphl	Pseudobarbus phlegethon (Barnard, 1938)	Fiery Redfin	Cyprinidae	
Pqua	Pseudobarbus quathlambae (Barnard, 1938)	Drakensberg Minnow	Cyprinidae	

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Pten	Pseudobarbus tenuis (Barnard, 1938)	Slender Redfin	Cyprinidae	
Pphi	Pseudocrenilabrus philander (Weber, 1897)	Southern Mouthbrooder	Cichlidae	Native
Rdew	Redigobius dewaali (Weber, 1897)	Checked Goby (M)	Gobiidae	
Rmau	Rhabdalestes maunensis (Fowler, 1935)	Slender Robber	Characidae	
Stru	Salmo trutta Linnaeus, 1758	Brown Trout (Ex)	Salmonidae	Introduced
Sfon	Salvelinus fontinalis (Mitchill, 1815)	Brook Charr (Ex)	Salmonidae	
Sbai	Sandelia bainsii Castelnau, 1861	Eastern Cape Rocky	Anabantidae	
Scap	Sandelia capensis (Cuvier, 1831)	Cape Kurper	Anabantidae	
Scar	Sargochromis carlottae (Boulenger, 1905)	Rainbow Bream	Cichlidae	
Scod	Sargochromis codringtonii (Boulenger, 1908)	Green Bream	Cichlidae	
Scou	Sargochromis coulteri (Bell-Cross, 1975)	Cunene Bream	Cichlidae	
Sgia	Sargochromis giardi (Pellegrin, 1903)	Pink Bream	Cichlidae	
Sgre	Sargochromis greenwoodi (Bell-Cross, 1975)	Greenwood'S Bream	Cichlidae	
Smor	Sargochromis mortimeri (Bell-Cross, 1975)	Mortimer'S Bream	Cichlidae	
Sint	Schilbe intermedius Rüppell, 1832	Silver Catfish	Schilbeidae	Native
Syan	Schilbe yangambianus (Poll, 1954)	Yangambi Buttercatfish	Schilbeidae	
Smah	Schwetzochromis machadoi (Poll, 1967)	Cunene Dwarf Bream	Cichlidae	
Salt	Serranochromis altus Winemiller & Kelso-Winemiller	Humpback Largemouth	Cichlidae	
Sang	Serranochromis angusticeps (Boulenger, 1907)	Thinface Largemouth	Cichlidae	
Slon	Serranochromis longimanus (Boulenger, 1911)	Longfin Largemouth	Cichlidae	
Smao	Serranochromis macrocephalus (Boulenger, 1899)	Purpleface Largemouth	Cichlidae	
Smer	Serranochromis meridianus Jubb, 1967	Lowveld Largemouth	Cichlidae	Native
Srob	Serranochromis robustus jallae (Boulenger, 1896)	Nembwe	Cichlidae	
Srob_Dup	Serranochromis robustus robustus (Günther, 1896)	Tsungwa	Cichlidae	
Sthu	Serranochromis thumbergi (Castelnau, 1861)	Brownspot Largemouth	Cichlidae	
Ssib	Silhouettea sibayi Farquharson, 1970	Sibayi Goby (M)	Gobiidae	
Sken	Stenogobius kenyae Smith 1959	Africa Rivergoby (M)	Gobiidae	
Slei	Strongylura leiura (Bleeker, 1851)	Yellowfin Needlefish (Ms)	Belonidae	
Sleo	Synodontis leopardinus Pellegrin, 1914	Leopard Squeaker	Mochokidae	
Smac	Synodontis macrostigma Boulenger, 1911	Large-Spot Squeaker	Mochokidae	
Smar	Synodontis macrostoma Skelton & White, 1990	Largemouth Squeaker	Mochokidae	
Sneb	Synodontis nebulosus Peters, 1852	Cloudy Squeaker	Mochokidae	

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Snig	Synodontis nigromaculatus Boulenger, 1905	Spotted Squeaker	Mochokidae	
Stha	Synodontis thamalakanensis Fowler, 1935	Bubblebarb Squeaker	Mochokidae	
Svan	Synodontis vanderwaali Skelton & White, 1990	Finetooth Squeaker	Mochokidae	
Swoo	Synodontis woosnami Boulenger, 1911	Upper Zambezi Squeaker	Mochokidae	
Szam	Synodontis zambezensis Peters, 1852	Brown Squeaker	Mochokidae	Native
Talb	Thoracochromis albolabris (Trewavas & Thys van den	Thicklipped Happy	Cichlidae	
Tbuy	Thoracochromis buysi (Penrith, 1970)	Namib Happy	Cichlidae	
Tgui	Tilapia guinasana Trewavas, 1936	Otjikoto Tilapia	Cichlidae	
Tren	Tilapia rendalli (Boulenger, 1896)	Redbreast Tilapia	Cichlidae	Native
Truw	Tilapia ruweti (Poll & Thys van den Audenaerde, 19	Okavango Tilapia	Cichlidae	
Tspa	Tilapia sparrmanii Smith, 1840	Banded Tilapia	Cichlidae	Native
Ttin	Tinca tinca (Linnaeus, 1758)	Tench (Ex)	Cyprinidae	
Ttri	Trichogaster trichopterus	Gourami (Ex)	Anabantidae	
Vcun	Valamugil cunnesius (Valenciennes, 1836)	Longarm Mullet (Ms)	Mugilidae	
Vnas	Varicorhinus nasutus Gilchrist & Thompson, 1911	Shortsnout Chiselmouth	Cyprinidae	
Vnel	Varicorhinus nelspruitensis Gilchrist & Thompson,	Incomati Chiselmouth	Cyprinidae	Native
Vpun	Varicorhinus pungweensis Jubb, 1959	Pungwe Chiselmouth	Cyprinidae	
Xhel	Xiphophorus helleri Heckel, 1848	Swordtail (Ex)	Poeciliidae	Introduced
Xmac	Xiphophorus maculatus (Gunther, 1866)	Platy (Ex)	Poeciliidae	

Index

Add, edit or delete a Site 14
Add, edit or delete a Site Visit 14
Adding Assessors via Rivers Client 36
Change your password 3
Check for existing rivers 6
Creating a new query 40
Creating a new river 6
Data ownership 5
Data transfer 35
    Data Uploading 35
    Data Downloading 36
Documentation 8, 48
Downloading Updates 39
Glossary 52
Importing SASS data 36
Installing the Rivers application 49
Login to the Rivers Client 3
Login to the Rivers Server 3
Managing Rivers 6
Navigating the River Tree View 12, 14
Navigating to Sites and Site Visits 12, 14
Query Master 2, 40
    Defining Filter Criteria 40
    Display report 41
    Example 53
    Field Selection 40
    Frequently asked questions 47
    Output 42
    Primary Data Component 40
    Secondary Data Component 40
    Setting criteria 46
    Step-by-step instructions on using the QM 40
References 50
Register as a new user 3
Reporting bugs or error messages 50
Rivers Client 2, 12
Rivers Server 1, 6
Searching by River or Site 13
Site Data: Section A 17
    General Site information 17
    Spatial Information 18
    Location Details 18
    Site Transaction 19
Site Visit: Section B - General 22
    Condition of Catchment 22
    Channel Condition 22
    Channel Morphology 22

Site Visit: Section B – Index of Habitat Integrity 25
Site Visit: Section C 28
General Site Visit Information 28
Water Chemistry 28
Stream Dimensions 29
Substratum Composition 29
Invertebrate Biotopes 29
Invertebrates 29
Biotopes Sampled (IHAS) 30
Fish 30
Software and Hardware Requirements 49
Support for Rivers Database Users 50
System access 3
Technical information 49
Uninstalling the Rivers application 49
Uploading site photographs 7
Viewing and adding Site data 17
Viewing and adding Site Visit data 21
Section B – General 22
Section B – Index of Habitat Integrity 25
Section C 28
Viewing existing rivers, tributaries and associated sites 7
Viewing SASS proficiency status 36